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ARCHÆOLOGY.

ARCHÆOLOGICAL EXPLORATIONS IN TENNESSEE.

BY PROF. F. W. PUTNAM, PEABODY MUSEUM.

(*Continued.*)

Of articles made of shells, several forms occurred in the graves in this mound, the most common being the spoons made of the valves of the *Unio*. These spoons, as will be seen by the illustration (Fig. 30), were very convenient and useful domestic articles. Many of them were found in the graves, and generally in such vessels as food would naturally be placed in, but owing to the decay of the thin shell, few could be handled without crumbling into chalky particles. Six were, however, saved from the graves in mound 1, and several others were collected afterward in different localities. All of those from the graves in the mound were made from the right valves of the mussels, and indicate right-handedness, as the rule, with this people.* They were made by cutting away the thick portion of the shell along the hinge, and also the thin portion of the lip. The shell was then further cut away on its upper part, leaving the projecting handle as shown in the figure, which, from the position in which the spoon was placed by the artist, does not convey as good an idea of the thing itself as would be the case if the drawing had been reversed, and the handle part of the spoon placed in the right

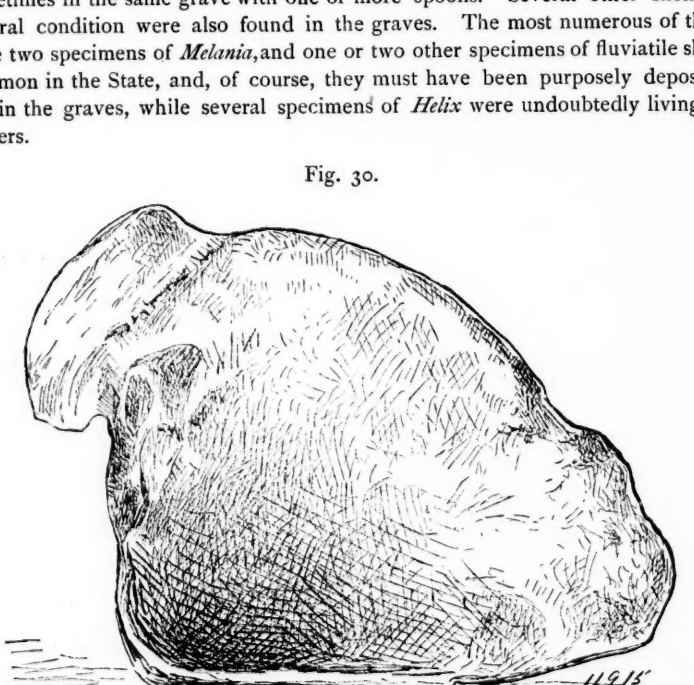
*I have since examined over thirty of these shell spoons, now in the Museum, and all are made from the right valves of *Unionidæ*, and so shaped as to be most conveniently used with the right hand.

XUM

hand lower corner. This would bring the valve of the shell in its natural position, and also show the spoon in its most convenient position for use in the right hand. In some specimens the handle is not rounded and smoothly cut, as in the one figured, but is deeply notched on its outer edge as if for ornament.

Many natural valves of several species of *Unionidæ* were found in the graves, sometimes in the same grave with one or more spoons. Several other shells in natural condition were also found in the graves. The most numerous of these were two specimens of *Melania*, and one or two other specimens of fluviatile shells common in the State, and, of course, they must have been purposely deposited within the graves, while several specimens of *Helix* were undoubtedly living intruders.

Fig. 30.



Spoon made from Shell of Unio, Stone-grave Mound. Natural size.

In one grave, near the head, were several hundred specimens (11934) of the little *Olivella*, identified by Prof. Hamlin, of the Zoölogical Museum, as *O. mutica* Say, of the Southern Atlantic coast. Every one of these little shells, which are not much over a quarter of an inch in length, has the apex ground off, thus making a hole through the shell by which it could be strung, the whole lot in question probably having once formed a necklace, or head ornament of great value to its owner. The occurrence of this and other marine shells is another indication of intertribal intercourse, or of extensive wanderings on the part of this ancient people.

In three other graves in this mound, beads made from marine shells were found. These beads were the same as those obtained from the mounds throughout the country, and have been cut principally from large marine shells, such as *Strombus*, *Busycon*, etc. Similar beads are figured in the last Report, p. 85, fig. 1. Many of the beads in this mound were very much decayed. Those that were collected are of three forms.

In the grave in which the perforated bear's teeth were found was one large, oval and symmetrical bead, three-quarters of an inch long and one-half an inch in diameter. About one hundred other smaller, well finished beads, with a diameter of about a quarter of an inch, and a length of about two-thirds the diameter, formed the rest of what I believe was a necklace, which we could probably reconstruct by placing the large bead and the two bear's teeth in the center with the small rounded beads on each side.

In another grave in which were several common, fresh-water shells, were also a number of beads very much decayed, but about twenty were saved. These are of two kinds, a small rounded form about a third of an inch long, and a flat bead having a thickness of not over an eighth of an inch, and a diameter of about one-half of an inch. In another grave was found a single bead like the last described.

In closing this account of the contents of the mound, I must reiterate that not a single article was found indicating contact with any other people than different tribes of their own race, and the same applies to all the other mounds of this important group on Miss Bowling's farm.

Having a desire to make an examination of one of the large mounds, of which there are many still remaining in the Cumberland valley, I accepted the invitation of the Rev. M. A. Matthews to explore one on land belonging to the family of Mrs. Matthews, and known, from the name of the family, as the Love Mound.

This large mound is twenty-three feet high, and, as near as measurements could be made, owing to the washing of the banks, 155 feet in diameter in a north-south line, and 147 feet in an east-west direction. It is located near the East Fork of White Creek, which flows in a southwestern direction to the Cumberland, entering that river about six miles distant in an air line.

In the immediate vicinity of the mound, on the north, west and south, are large artificial depressions, showing where the earth forming the mound was obtained. The excavations on the north and south have left a slight ridge, about a hundred feet in width and several hundred feet in length, to the eastward of the mound. About two hundred feet to the north of the end of this ridge is a small mound, nearly obliterated by cultivation, and about three times the distance to the southeast is an outcrop of limestone. Along this ridge, and towards the limestone ledge, are the traces of many stone graves of the same character as those already described. These graves had nearly all been destroyed by continued cultivation of the land, and I found but one that had not been disturbed. This grave was

six feet long, twenty-two inches wide and eighteen inches deep. The body had been placed in the grave with the head to the west. The skeleton was so far decayed that only a few of the bones could be saved, and the only article found in the grave was a portion of an ear ornament in contact with the side of the skull. This ear-drop was made of a piece of wood covered with a thin layer of copper.

An excavation was made in the center of the small mound, but nothing was discovered except the indications of a fire a few feet from what is now the surface of the mound.

The large mound was a land-mark at the settlement of the place, in 1795, by Joseph Love, the grandfather of Mrs. Matthews, and its summit has been used as a family cemetery, which somewhat interfered with the work of exploration.

In 1795 Mr. Love, as reliable family tradition states, "found a heavy growth of timber on the mound, and decayed stumps of red oak trees that were over two feet in diameter." Twenty-five years ago the mound was cleared of timber with a view of cultivating the sides, but as they were found to be too steep, it was again left to nature. The trees which cover the mound at present are, therefore, less than twenty-five years of age.

Four days, with six to eight men each day, were given to the exploration of this mound, in the following manner: A trench, four feet wide and forty-four feet in length, was cut on the southern side of the mound in its central portion, and running east and west. This trench was dug to the depth of ten feet. Two other trenches, fifteen feet apart, of the same width as the first, were then started from the first trench. The westernmost of these was carried eleven feet directly north, so as to reach as near the center of the mound as possible, without disturbing the several graves on the summit, The other trench was carried sixteen feet in a northwesterly direction, the two trenches terminating between ten and eleven feet apart. These two trenches were dug to a depth of twenty-three feet, when the original black soil was reached, upon which the mound was erected. At the bottom and ends of these trenches, tunnels were started so as to reach the center of the mound. Eight feet in length was thus added to the trenches, and from these tunnels auger borings, three feet in length, were made in all directions, without meeting with the slightest indication of a central chamber or relic of any kind. At it seemed useless to continue the exploration, the trenches were filled and the mound restored to its former shape.

The earth of which this mound was composed had been brought in small quantities, probably in baskets, and the outline of each little load could be distinctly seen on the sides of the trenches. This earth had, through the long period of time that must have elapsed since the mound was erected, become dry and compact and nearly as hard as sandstone. It was, therefore, necessary to loosen it by the pick, and much was thrown from the trenches in lumps by the workmen. The fineness of the material, and its freedom from stones and pebbles, were noticed by all at work, and it appeared as if the earth had been carefully sifted before it was placed on the mound. In the nearly five hundred cubic yards of earth removed

from the trenches, only the following extraneous things were found: In the long trench, at the depth of three and five feet, two small fragments of cannel coal, and at the depth of five and six feet, two small pieces of greatly decomposed limestone. In the two trenches diverging from the first made, and at depths of three, five and eight feet, four small pieces of limestone and a fragment of flint were found. At fourteen feet a piece of the shell of a *Unio* was discovered, while three or four flint chips and as many minute pieces of sandstone and limestone were thrown out at various depths. In the trenches near the center, at a depth of thirteen feet, were found three slabs of decomposed limestone, each of about twelve by eighteen inches, and one inch in thickness. The position in which these stones were found was such as to indicate that they were part of a circle of stones around the center of the mound when it had reached the height of ten feet. The decayed condition of these slabs of limestone and the formation, on the under side of each, of a thick scale of red oxide of iron, are indications of the great age of the mound itself.

The results of the exploration of this mound lead to the supposition that it was erected for some other purpose than as a monument over the remains of the dead, and, as the remains of numerous graves near it indicate a settlement at this place, it is very likely that it was devoted to some other important purpose of the people of the town.

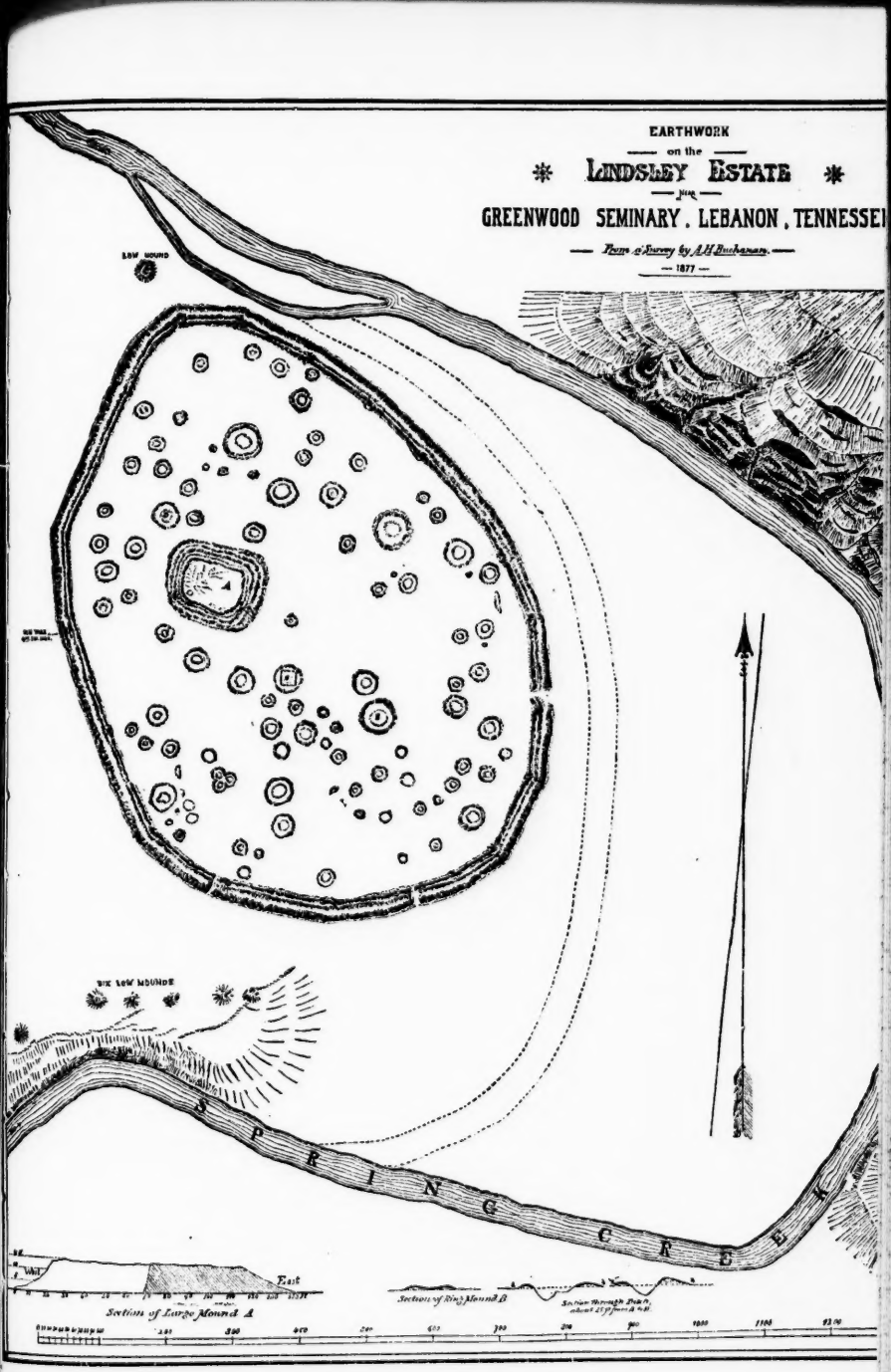
The most important of my explorations were those within the earthwork near Lebanon, in Wilson county, and about sixty miles east from Nashville. At this place, on the farm of Dr. Samuel Crockett, included in the estate of the Lindsley family, who were early settlers in the county, are the remains of an extensive settlement of the Moundbuilders of Tennessee. Accepting the kind invitation of Mrs. N. Lawrence Lindsley, Principal of the Greenwood Seminary, I was enabled, by her coöperation and the assistance of Mrs. Henry Lindsley, Dr. Crockett, and twenty-five workmen, to make, in a week's time, a comparatively thorough exploration of these remains, for an accurate survey of which, reproduced on the accompanying cut, I am indebted to Prof. J. H. Buchanan, of Lebanon.

As will be seen by an examination of the map, Spring Creek, a tributary of the Cumberland, makes at this place a bend to the eastward, where there is a limestone bluff. In this bend, near its narrowest part, is located an earthwork inclosing an area of between ten and eleven acres, and having its greatest length, of about 900 feet, in a north-south direction, and a width from east to west of about 650 feet. At nearly regular distances along this embankment, on the inside, are slight elevations at the angles of the earthwork. These are now eighteen inches higher than the embankment between the angles, and slope uniformly to the bottom of the ditch, which was originally, probably, between three and four feet in depth. Between the angles, the top of the inner wall is now not much over a foot above the general level, and the slope to the bottom of the ditch is divided into two parts by a level bench nearly three feet in width. The outside slope of the ditch, throughout, is uniform from top to bottom, and along its

outer edge is a crest about six inches high. The sections at the bottom of the map illustrate this structure—*a* the outer, and *b* the inner side of the ditch. At the eastern and southern portions of the inclosure are three causeways or openings through the embankment. Near the northwestern end, between the embankment and the creek, is a low mound, the existence of which I was not aware until the survey was made by Prof. Buchanan, after the rank vegetation, which covered everything at the time of my visit, had been destroyed by the frosts. At this portion of the inclosure, and to the southeast, the land is very low, and in the time of spring floods must be washed by the overflow from the creek. To the westward the land rises, and at the southwestern corner of the inclosure there is a rocky portion twenty to twenty-five feet higher than along the eastern embankment. Still further to the southwest, near the creek, the land is thirty feet higher than at the point near the creek on the northern side. On this southern bluff are six mounds, only a few feet in height, situated as shown on the map. Two of these mounds I caused to be trenched, and found that they were constructed of earth and stones which had subsequently been heated and burned by long continued fires, and there was no indication of their having been used for any other purpose. In the ditch, on the western side, is a large elm three four feet two inches in diameter. On the summit of the large mound within the inclosure were several large trees, among them a poplar two and a half feet in diameter, and a hackberry two feet in diameter.

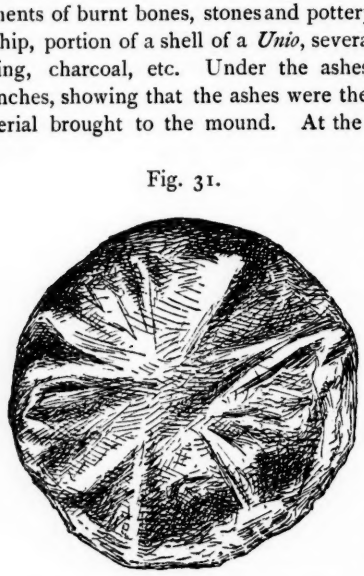
Many other trees of considerable size were growing within the inclosure, and several large trees had fallen and gone to decay. While this tree growth does not, in all probability, give any approximation to the period when this ancient town was deserted, it at least points to a time before the intrusion of our own race, and everything found within the inclosure was confirmatory of the antiquity of the place. To the east of the embankment there is a depression, following the curve of the wall on that side, indicated on the map by parallel dotted lines, which looks like a former channel of the creek; and it is very likely that when the earthwork was made the creek flowed near the eastern wall, and has since cut its way four or five hundred feet farther to the eastward. The geological structure, contour of the land, and direction of the natural flow of the creek, are all favorable to such a change in the course of centuries.

The first object of attention in the inclosure is the large mound marked *A* on the map, and also shown in section at the bottom. This mound, as shown by the section (the shaded part in which represents the portion excavated), has steep sides and a flat top. Its dimensions are 138 feet by 120 at its base, and 95 by 75 feet on its summit, with a height of 15 feet. A trench was cut from the base of the eastern side and carried to the center, beginning with a width of four feet and gradually widening to fourteen. After the center was reached that portion was deepened to eighteen feet from the summit, thus digging down three feet in the original soil, consisting of yellow gravel and clay, which was found to have been previously undisturbed. The earth of which the mound was composed was


EARTHWORK
on the
LINDSLEY ESTATE
near
GREENWOOD SEMINARY, LEBANON, TENNESSEE
From a Survey by A.H. Buchanan.
1877
LOW MOUND
SIX LOW MOUNDS
SPRING CREEK
East
Section of Large Mound A
Section of Ring Mound B

very hard, dry and compact, and necessitated the use of the pick. The construction was the same as that of the Love Mound. At a depth of between three and four feet from the surface, near the center, were found three slabs of stone, each about twelve by sixteen inches, a stone chip, piece of mica, fragment of pottery, and a discoidal piece of sandstone (Fig. 31), with several grooves upon its surface, indicating that it had been used as a sharpening stone. At a depth of between seven and eight feet was an ash bed that had evidently extended over the surface of the mound when at the height of seven feet. In this bed of ashes were fragments of burnt bones, stones and pottery, a discoidal stone, an arrow-head, flint chip, portion of a shell of a *Unio*, several burnt corn cobs, a piece of charred matting, charcoal, etc. Under the ashes the earth was burnt to a depth of a few inches, showing that the ashes were the remains of a fire on the spot, and not material brought to the mound. At the depth of thirteen feet, a piece of cedar, a few inches in diameter and much decayed, was found standing upright, with its base below the surface of the earth upon which the mound had been erected. Between fourteen and fifteen feet, and thus on or close to the original soil, was another extensive bed of ashes, in which a few burnt bones of deer and pieces of charcoal were found.

Fig. 31.



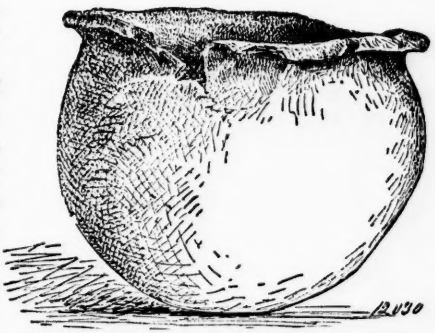
Sharpening Stone, from Large Mound within Earthwork. Natural size.

The examination, therefore, showed that this was not a burial mound, and the two fires that had been made, with the relics found in the ashes, lead to the supposition that it was erected in connection with some peculiar rites celebrated at two periods during its construction. The place may have been the site of an important building. It is very likely that one stood upon the summit of the mound, and that all traces of it have been washed away after the decay of the structure, as would be expected upon such an exposed position.

To the southeast of the large mound, was one, marked *C* on the map, which was nearly three feet in height and forty-seven in extreme diameter, having a slight central depression twenty-six feet in diameter. On removing the earth, this mound was found to contain sixty stone graves, arranged in the form of a hollow square about the outer portion of the mound, in two or three irregular rows and in three tiers. The graves were carefully made with large flat stones, in the same manner as those I have already described, and were all of large size. The examination showed that, with the exception of one child buried in the same grave with an adult, all the bodies were adults and had been placed at full length in the graves.

The grave containing the bones of a child with those of an adult person, was in the lowest tier and among the first made. In this grave was found a large dish made of pottery, like the one represented in figure 34, and in this dish was the bowl (Fig. 32), reproduced of one-half its diameter. A small discoidal stone (Fig. 33) was also found in this grave, and is shown of natural size. Near this grave, on the inner side, were found the remains of a body that had not been inclosed in stone, and this was the only instance of the kind found in the mound. The skull belonging to this skeleton was saved (12003). In the lowest tier of graves was one that contained the remains of two skeletons, the skulls of which were saved (12014, 15). The only article found in this grave was a dish similar to No. 12009, which is figured.

Fig 32.



Bowl from grave, Burial Mound within Earthwork. ½.

In another of the graves of this lowest tier, in which the skeleton was much decayed, the following articles were found: A jar (12018), at the feet of the skeleton; near it the dish (12009) of which figure 34 is a representation, reduced to one half its diameter. With the bones of the hand was a pipe (12011) made of sandstone, which is shown of full size by figure 35. In the dish was a large bone of deer's leg (12010), which had been cut and broken, and near the dish was a small mass of graphite (12012), a pebble and a flint chip (12013).

Fig. 33.

Discoidal Stone from grave, Burial Mound, within Earthwork. Natural size.

In another of the graves of this lowest tier, were found the following articles: An ornament of very thin copper (12021), which was originally circular and with corrugated surface. Only fragments of this could be preserved, and its full size could not be determined, though it was probably four or five inches in diameter. An earthen pot, (12025), a dish (12024), and the skull (12022) were also secured. The remainder of these oldest graves in the mound yielded only fragments of pottery. As the earth of the mound was very damp, the pottery was soft and the bones were much decayed, so that great difficulty was experienced in taking the articles out, and it was necessary to have the pottery carefully dried before it could be handled.

Several of the skeletons showed the effects of inflammatory diseases, and a number of specimens of pathological interest were obtained.

In the middle and upper tiers, several graves were found containing relics. In one were portions of an ornament, circular in shape and about five inches in diameter, made of two sheets of copper closely united (12023), similar to that found in one of the oldest graves, and, like that, also resting on the breast bone, which, with the ribs, had been discolored and preserved by its contact. In this grave were also three delicate and well-made arrow-heads (12020), and an earthen pot (12019, Fig. 36).

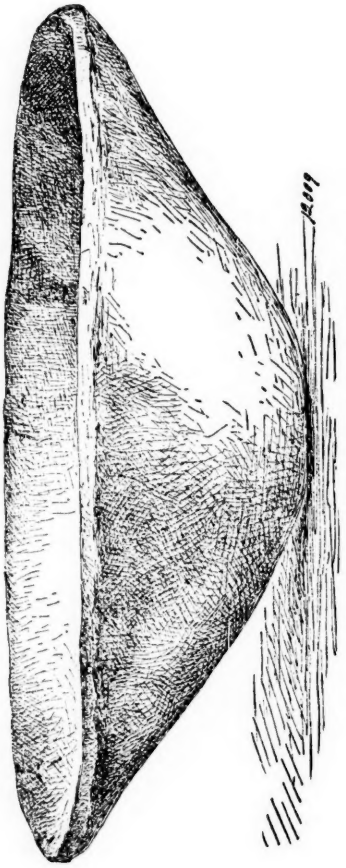


Fig. 34. Dish from grave, Burial Mound within Earthwork. ½.

In another grave were found three articles of pottery, viz.: a vessel with handles (12034), a large dish (12035), and a water jar (12033) of a pattern similar to others found, and represented by figure 37.

A similar jar of slightly different shape (Fig. 38), having the surface divided into portions as if designed after a gourd, was found at the feet of a skeleton.

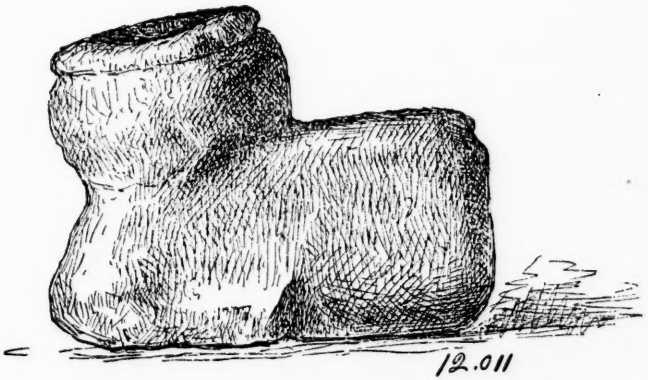
Figure 39 represents a potsherd (12005) taken from one of the graves. This is probably a portion of a small bowl, and is an attempt, it seems to me, at a reproduction of the head of a bat the features of which are more apparent in the fragment than in the figure.

Pieces of mica (12038) were also found in one of the graves, and in another was a pipe (12040) carved from a dark slate (Fig. 40), which is of interest from its resemblance in form to pipes of recent manufacture.

In the earth between the graves, numerous fragments of pottery and a few perfect vessels were found. In one of the pots were two of the shell spoons of which mention has been made on a preceding page. A discoidal stone was also obtained. Between two of the graves, nearest the surface, was found the interesting pipe (11993), carved from green steatite, and representing a man holding a

cooking vessel which forms the bowl of the pipe, the hole for the insertion of the stem being in his back. The three views given in figures 41, 42 and 43, will con-

Fig. 35.



Pipe made of Sandstone, from grave, Burial Mound within Earthwork.

vey a better idea, than words, of this interesting relic. The lower portion of the figure is left unfinished as if that part had been inserted in a base of some other material, which is also indicated by a hole in the stump of the right leg.

GEOGRAPHICAL NOTES.

PROCEEDINGS OF THE CALIFORNIA ACADEMY OF SCIENCES, JUNE 16, 1879.

RECEPTION TO THE OFFICERS OF THE JEANNETTE.

A special meeting of the Academy of Sciences was held June 16, for the purpose of giving a reception to Lieutenant DeLong and the officers of the Bennett Exploring Expedition to the North Pole, who are to start in a few days in the steam yacht *Jeannette* from this port. The interest manifested in this expedition is very great, from the fact that it was started by the enterprise and liberality of the proprietor of the New York *Herald*, and, besides, the Government has recognized its importance by detailing competent and skillful officers to direct its operations. A large number of ladies and gentlemen were present last evening to listen to the exercises. Dr. H. W. Harkness, Vice President of the Academy,

presided, in the absence of President Professor George Davidson on official business.

The following members of the expedition were seated on the platform: Lieut. S. W. DeLong, U. S. N., Commander; Lieut. C. W. Chipp, U. S. N., Executive Officer; Lieut, J. W. Dannheimer, U. S. N., Navigator; G. W. Melville, U. S. N., Chief Engineer; J. W. Ambler, Passed Assistant Surgeon; Jerome J. Collins, Meteorologist and special correspondent of the New York *Herald*, and R. L. Newcomb, Naturalist. Beside these were Charles Wolcott Brooks, ex-Consul of Japan, and William Bradford, the artist.

The first thing in the order of exercises was the reading of the following paper on

ARCTIC DISCOVERY.

BY A. B. STOUT, M. D.

MR. PRESIDENT AND FELLOW MEMBERS:—When, on a former occasion, we advocated the passage of a resolution by this Academy, addressed to the Congress

of the United States, advocating and soliciting the desired authority and appropriation of funds to organize the Howgate Expedition, to explore the Arctic Zone, and, if possible, reach as far north as the North Pole, the objective question was asked (and properly enough), "In what good can it result?" *Cui bono?* The answer was, that a full reply to the query would fill an octavo volume. We now offer a concise and condensed answer to the question.

To recapitulate the past as completely as may be, we offer the accompanying tabulation, which we hold yet open for correction, of Arctic explorations to the present time. This may offer a bird's-eye view of a landscape more sublime—more gorgeously colored than ever human painter aspired to portray.

The suggested resolution was adopted and transmitted to the Senate of the United States. The appreciative thanks of Captain Howgate for the sympathy of the Academy in his projected expedition have been duly rendered. The coöperation of the West has been appreciated at the East.

To advance another step to-night; to accelerate the onward march to the North Pole of our hopes; to yet further interest this Academy in a scientific search which now enlists the ardent impulse of every scientific academy of the civilized world; to endeavor to warm every sympathy international; to ingraft on our Government, which represents the progressive spirit of an enlightened people, aspiring to and indispensably requiring every aid in science to its practical promotion, is, in faithful zeal, the object of this communication.

To-day two great enterprises propose to record their birth date.

First—The Howgate Colony Expedition, already inaugurated by Congress, and commenced by the preliminary outfit under Captain Tyson to Disco Island to gather supplies and equipment for the so-termed Howgate Exploration.

Second—The Bennett Expedition, under Lieutenant DeLong, in the *Jeannette*, to take its departure from San Francisco on or about June 20, 1879. May our Academy wish them both God-speed on their eventful voyage!

It would be presumption on my part to expatiate upon the important problems in Astronomy to be solved by the discovery of the North Pole. These are scientifically indicated by W. E. Hickson, Esq, in a paper on the climate of the North Pole. [See Journal R., Geog. Soc. vol. 35, p. 129, 1665.]

Herein is a clear elucidation of the effect on Arctic summer and winter of the earth's relation to the sun; of the necessity to fix with precision the location of the Pole—to determine the flatness or the projection of the earth's surface at the Pole—to measure arcs of meridians; to give greater exactitude to the fixation of latitude and longitude of cities; to show the alterations of climate in long cycles of time; to compute the gradual variation of the plane of the ecliptic to that of the equator, with the consequent meteorological conditions. This author inclines to the belief that land exists at the Pole, and proposes, in order to complete astronomical observations requiring time for their consummation, that all interested scientific nations shall combine to erect there an international observatory. With steam power to aid, he sets no limit to his proud ambition.

Captain Sherard Osborn, writing in 1866 (Journal R. Geog. Society, vol. 36), says most truly: "Arctic discovery must always claim the attention of all true lovers of geography and physical science, especially that of a society which represents the deep interest recently exhibited by all grades of the public in the solution of the problem of a communication between the Pacific and Atlantic, and of the world-wide sympathy in the noble devotion by which that mystery was solved." He informs us that, from an estimate of Sir Leopold McClintock, the foot expeditions in search of Franklin alone, measure 40,000 miles, and that during thirty-six years of explorations by ship, boat and sledge, England only lost fairly one expedition, in forty-two successive expeditions only lost 128 men, and of one hundred sledge parties, not one has been sacrificed. He further states in extenuation of the perils, hardships, starvations, and dreadful exposures of life, that "the fact is, more sailors have been thrown to the sharks from the diseases incident to service in China, and on the coast of Africa, than ever fell in thirty years of Arctic service."

He calculates that from where, in 1827, Sir Edward Parry, in his boat expedition from Spitzbergen, stood on a sea of floating ice, on the night of July 22, 1827, in latitude 80° 45′, he was exactly 435 miles from the Pole. This distance, doubled for the return journey, gives 870 miles to travel; but Parry was defeated because the floating ice-field was carrying him faster to the south than his men could drag the sledges to the north.

From Cape Parry to the Pole and return is only 968 miles; while, in 1853, McClintock traveled 1220 miles in 105 days. Meacham, in 1854, marched 1157 miles in seventy days. In fine, Captain Osborn, in his enthusiasm, rather courts than shuns Arctic life; proves its endurability, in spite of its rigors, by the health and vigor of the "Arctic Highlanders," and presents, as the reward of the great achievement, 1,131,000 square miles of the globe's surface

A letter to Sir R. J. Murchison, from David Gray, Esquire, a whaler, in 1868, is worthy of note as indicating a fourth route to the Pole (Pro. R. G. S., v. 12, No. III.). It gives most cogent reasons for the adoption of this route, especially as it avoids the rush of water and ice southward through Smith Sound and Baffin's Bay.

Gilbert, in 1600, announced the bold hypothesis that "the earth is a great magnet," but he did not announce the cause or origin of the magnetism. But it was in 1576 that Robert Norman first discovered the dip or inclination of the magnetic needle, on the ground that if, at the magnetic equator, the needle poised precisely horizontally, it must follow the curvature of the earth and dip as the needle was removed from the magnetic equator toward either the North or South Pole.

We have not space to enumerate the various and conflicting hypotheses advanced to explain this astonishing terrestrial magnetism. But the problem still remains to be solved. No explanation has yet passed the crucial test of scientific investigation. The nearest approximation has not yet met with conclusive confirmation.

XUM

Gauss, Ampére, Hausteen, Goldsmidt, and others, studied the phenomena of magnetic currents, and the needle's dip and variation as they existed in fact, but did not prove the origin of the magnetism. Practical results of great value were obtained. Finally, General Sabine discovered and announced, that under the various intensities of the action of the sun on the earth, the magnetic phenomena of the latter received very demonstrable variations in direction and intensity.

In the United States, Professor Bache, aided by numerous scientists, among whom figures the name of Dr. Kane, and also the United States Coast Survey, have together made important magnetic charts for the aid of navigators, and explorers on land. If General Sabine has demonstrated an important dependence of the earth upon solar magnetism for its magnetic phenomena, Dr. Kriel, of Austria, has endeavored to enlist the moon as a potent factor in terrestrial magnetism Professor Schwabe, German, has, by thirty years of daily observations, demonstrated that important relations exist between the variations of terrestrial magnetic intensities and the variations of the sun spots "brighter than the sun" [See *Popular Science Monthly*, Sept., 1874, p. 536], thus giving testimony in favor of Sabine's researches.

However advanced this state of knowledge may be, it is still surrounded by an obscurity not yet resolved into unclouded light. The "open sea" of conjecture, ice-bound as it may be, is free to the suggestions of all explorers. It even may yet be the destiny of some unpretending whaler to reach the North Pole in advance of the efforts of science, aided with all the power of steam.

We may, then, venture upon an hypothetical solution. The velocity of the earth's motion in its orbit around the sun is computed at 68,000 miles per hour, or 1,632,000 miles per day. The velocity of the earth's rotation on its axis is calculated at 1,000 miles per hour, or 24,000 miles in twenty-four hours.

In accordance with the law of correlation of forces, we may consider that motion is converted into magnetism by the action of friction. Certainly, in the immense velocity of the earth's motion, in atmosphere as well as in the ether space external to the earth's atmosphere, there is friction.

However attenuated may be the ether in which atoms move, there is still some friction. The earth, in its orbit around the sun, moves in a medium of different density than that of the planet on its axis; hence the quality, the quantity and the intensity of the magnetism, or dynamo-electricity, evolved by the two velocities in different media, would also be differentiated.

Again, if the earth's motion be converted by friction into magnetism, the friction being over the entire surface, the evolved magnetism must alike be generated over the entire surface everywhere within its range; but in accordance with natural laws, the product is collected or attracted into great magnetic currents, as the waters of the ocean are organized into great gulf streams.

The magnetic currents generated by the earth's motion on its axis could not stream through the exact geographical axis, but would be deflected, and therefore

we have magnetic poles removed a distance from the true North Pole. It is evident, also, that herein the sun's action on the earth would have its influence on the direction of the magnetic currents.

Within these two great streams of magnetism, either sufficient in force and never-failing supply to produce the terrestrial phenomena, and acting in differing lines, we have an intelligible origin of one of Nature's grandest and omnipresent energies.

The frost flower forms not on the window without its influence; the most elaborate crystal is the creature of its wonderful attraction. Eliminated in the brain, our thoughts are its children. Metamorphosed by the Divine will into a correlated force, Heaven's pure light illuminates the world. And, again, converted into heat, its genial warmth fertilizes every flower; while, in its turn, the solar beam relinquishes its unity of composition, and from its prismatic rays adorns in gorgeous coloring every petal, sports in fantastic grace with the feather of the bird and the beauteous wing of the butterfly, gilds the glowing morn, and at even, on western sky, utters in radiant colors its benediction, like the voice of God—good-night to weary man.

This faint picture brings us to the Aurora Borealis, that beautiful creation of the Polar Zone, that translucent light of the North, which man, with all his genius, can never imitate, but, like the Arab kneeling to the Sun, from the desert of his mind can only worship.

For a time, the perturbations of magnetic currents, strange variations of the needle, perplexing irregularities of the compass, often so fatal to mariners, were ascribed to caprice, were termed "fitful," so fitful as to become at times "magnetic storms;" but patient investigations like those of Schwabe have reduced this wild behavior to the regular events of natural laws, acting at certain recurring intervals. Astronomers have demonstrated that the motion of the earth on its axis, as well as in its orbit, is accompanied with an oscillation like the majestic swaying of a vast balloon. This motion must also act as a perturbating influence.

Now the motion of the earth, in its orbit around the sun, generates its own magnetism, which, in its turn, must be collected into its own determined currents, and these may circulate in lines widely different from the former great magnetic tide; these, also, may undergo perturbations depending upon the varying proximity and heat of the sun, as well as the condition of the luminous sun-spots, which, in their intensity of light, are represented to rival even the sun himself, as viewed by man.

Exultant in the wonderful beauty of these phenomena, as we sit, without peril, in our Temperate Zone, let us borrow a few lines from those who froze and trembled, but yet could not resist the glorious inspiration of Nature's majesty:

"During the first morning watch the sun, hitherto hidden by the mountains of Grinnell Land, suddenly shone out, causing a universal exclamation of wonder and delight. The line of reflected light was singularly brilliant where it crossed the patches of water, and it was rendered iridescent where it fell on the edges of

the hummocks, on the fractured ice, or on the pack itself. The irregular surface of the pack itself, comprising the general level of the young ice, the undulations of the old floes, and the sharp prominence of the old bergs, together with the unending diversity of form in the hummocks, kindled the imagination, which discovered every variety of form and of object, animate and inanimate.

"The bottoms of these floes are usually covered with small lakes, formed during the short summer by the melting of the ice and snow. These lakes are frozen solid during the winter, but in the summer and early autumn they reflect the sun from their surfaces, and exhibit a variety of colors beneath." [See N. P. Expedition of ship *Polaris*, pp. 77 and 98.]

Happy the nature-enamored enthusiast who, for a weary winter of darkness, can exult when he wins a reserved seat on a glacier, in the dress-circle of the Arctic Zone, thus illuminated, and revel with delight in this grand opera of Nature's play of colors. For our meek self, during a short season, we prefer a Boston rocking-chair, an opium pipe, and schoppen of lager. Under the hallucination of De Quincy, we would perceive the

"Borealis race
Which flits ere you can point the place,"

in a much more favorable light. These Arctic splendors are optical phenomena of reflection and polarization, but when they become blended with the still grander evolutions of terrestrial magnetism, an explanation appears to be found for the inimitably gorgeous pyrotechny of Northern Light. The effulgence of electricity, liberated from its unseen terrestrial current into brilliant light and prismatic colors, beams on the sky, illuminates with its fulminating rays the Northern Zone, and constitutes the Aurora Borealis.

What, then, are the advantages of Arctic exploration? What bounties will it return? What dividend from the stock? Of what good to man is this martyrdom of men?

We now seek in California some "high eminence" whence the heavens may be viewed through the most rarified, translucent atmosphere. What grander observatory can be found than the Pole itself? What more felicitous site to observe the inexhaustible fountains of terrestrial magnetism than at the fountains of its concentration and departure on its wonderful cosmic errand? Where better might a Tyndall borrow the elements of light, a Hemholz measure the free vibrations of sound, or a Geissler supply the tubes of his wondrous electric fountains and dazzling display of light?

When some thirty years ago a distinguished representative of California declared in Washington that California was a desert, and its land worthless for agriculture, and we now view its acres supplying the world with wheat, it cereals in every form filling the markets for the hungry, its luxurious vegetation adorning plain and hillside with its unrivaled scene of floral beauties, inviting exotics of every land to come and contest with them the palm of loveliness, the fruits so overwhelming in abundance that we fail to consume them, the products of the dairy,

which so immensely accumulate despite the cost of production—let us still remember that centuries ago a glacier mantle, far heavier than that which congeals the germs of life in Greenland, ploughed with corroding power over the now called heaven-blessed fields of California.

The achievement to first arrive at the North Pole and determine its physical "presentment," is no longer the actual competitive prize of international rivalry. Eager as each nation may be to win the victor's "belt," the attainment of that consummation, so devoutly to be desired, has become a secondary consideration. To cast a girdle round the globe is now a lightning-quick affair. To find the polar center of that great zone is now the struggle, though often baffled, yet surely destined to be accomplished. Meanwhile, science has adopted the field and its produce as her own. Higher primary objects have intervened, to decorate, to adorn, to illuminate the subject. Every polar expedition, whether or not a failure to find the pole, shortens the distance from 83° 26′ to the goal. Every station taken to measure soundings, to find warm and cold currents by thermometrical tests, to dredge from the vasty deep its forms of animal life, is an advance in science. To press into the service of science a tiny flower, which, by the quick telegraphy of a polar actinic ray, has in a few days burst open the frozen cerements of a nine months' glacier; to bring home a rock, a stone, to enhance geological lore and contribute its mite to the great story of this world; to tell what life existed by its fossil memorials and in its etchings on the land-marks by the graver of an almighty sculptor; to teach us the history of those grand cosmic revolutions which man yet fails, with all his labor, to unravel; to trace the course of the great current of the Pacific Ocean through the intricate straits and sounds of the Arctic waters into the Atlantic Gulf Stream; to profit by those tides instead of struggling by main force through Davis Straits in a counter current, manfully tilting with icebergs and northern gales; to show the route of the uprooted tree fallen from the banks of the Mississippi, in its wanderings on the ocean until, stranded on the Arctic shore, it gladdens the heart of a hungry Esquimaux, who warms with its heat his scanty evening meal, and inspires grateful orisons to his Creator.

All these, with objects yet unthought of, are the guerdons of the toil. What, though a hard and violent death may leave to many a zealous hero no other reward than the glory of his deeds, are not the earnest martyrs of science found on every field of life and in every clime? Would not the thought-exhausted Peteman have better found his storm-beaten monument by the side of Franklin, or where Hall died? Is not his unhappy fate the destiny of thousands of his too ambitious followers?

Quickly in the wake of science will follow commerce. Enterprising as she may be, she will not venture her argosies without high insurance. More stations, better charts, sharper defined coast lines, more thoroughly established "open water" must precede her cautious navigation. Still, with *her* success will be answered the mercenary *cui bono* inquiry.

The riches that have been derived from the polar latitudes are too immense

to be calculated to-day. Whale oil and spermaceti are not yet entirely superseded by gas and kerosene, and if they were so, whalebone or baleen is yet of high value. A whaler of to-day is paid for his voyage in baleen alone.

The discovery of coal in Behring's Straits and in a high latitude on the west coast of Greenland will greatly diminish expense, while the income will be in a far greater proportion increased. The produce of furs must be greatly augmented; the accession to the minor fisheries, with less peril to life and shorter voyages, cannot be estimated. In Siberian seas, salmon exist in countless multitudes. Many steamers navigate the great rivers of Northern Russia. With these trade will be opened. California wheat will penetrate to the interior of Russia, and American manufactures, now prized throughout the world, can pass Behring's Straits to be sold in Tobolsk, on the Obi.

Besides these, elephant ivory, walrus tusks, mosses, lichens, feathers, *et id omne genus*, abound to court the grasp of predatory man.

The cost of former Polar expeditions is far less than might be supposed. Thus, Willoughby's expedition, 300 years ago, cost $30,000; Moore's expedition, in 1746, $50,000; Back's expedition, in 1833-5, Great Fish River, $25,000; Meddendorf, Siberian, 1844, $8,583; Franklin expeditions, from 1848 to 1854, $4,166,665 (English Admiralty statement); German North Pole expedition (second), $55,000; Austro-Hungarian expedition, $91,665.

The cost of an ordinary whaling voyage of nine months, vessel of 300 tons, or 1,000 barrels of oil, including vessel's value, is about $35,000. A whaling vessel from San Francisco, from March to October, is calculated on those conditions. A whaling voyage from New England was fitted for three years at an investment of from $60,000 to $70,000.

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To counteract the depressing influence of intense cold requires the consumption of the great bulk of internal animal heat derived from the food eaten. It is only a comparatively small balance of energy, of vital force, which remains for the great labor demanded by the journey. More than one-half of the composition of the human body is fluid. An Indian skeleton, perfectly desiccated, now in our Museum, weighs nineteen pounds.

When, then, we remember that in the Arctic belt the thermometer sinks forty, ay, fifty, degrees below zero Fahrenheit, we inquire in wonder, Why does not all that fluid freeze, and in its congelation leave the man a lifeless statue of ice? Why does not the blood freeze in the heart? Why are not the blood channels by which the brain is irrigated, its loss and gain by wear replenished? Why are not the aqueous and vitreous humors of the eye crystallized into solid ice? It is because the supply of heat from the accelerated rush of blood through the system is called upon rapidly to supply the waste by the extreme cold. When this balance of power fails, the individual must die. This thirst for heat is manifested by the voracious appetites of Arctic hunters. When, then, this extraordinary effort of the brain to furnish the exalted heat strain is considered, without even

reference to the demand for great external manifestations of vital energy, it cannot be wondered at that the vital fire of life burns low, and all the structures of the body degenerate into that state we designate as scurvy.

A first curative relief, then, is to study the economy of this brain force and vital heat. No waste should be allowed by the expenditure of strength, except for indispensable necessities. We would deprecate exercises for mere amusement to keep men in motion, but recommend rest moments at well advised intervals

While stimulants are highly requisite, if we force the fire too rapidly by artificial fuels, in the long run we shorten the life to be consumed. Among the known anti-scorbutics, lime juice, raw vegetables, etc., the abundant Oregon cranberry ought to figure as valuable. Among trappers and hunters, pinole is highly prized. The earthy phosphates are powerful brain nutriments, but those of the alkalies have the objection that their large proportion of soda, potassa, or ammonia, thins and dilutes the blood. The Indian carriers of heavy loads in the Andes use the coca leaf. The action of this plant is to increase endurance, and obviate the almost irresistible desire to sleep in the most surprising manner. The fluid extract of coca, therefore, ought to be an invaluable aid; but as this freezes, and is difficult to transport, we have composed a dry powder condiment which every man can easily carry in his pocket. This condiment can give a relish to many a raw or revolting meal with which the Arctic explorer is forced to satisfy his long-forgotten Epicurean taste.

When the traveler in the North has acquired what may be called the scurvy diathesis, he is beset by another direful scourge. Frost-bite is greatly facilitated. His feet swell, and he must loosen his fur or canvas boots. The neuralgia in the frost-sores becomes excruciating, labor impossible, and the highest degree of nervous irritability is engendered. This pain, so much exaggerated beyond that of a simple local wound, indicates how intimately the state of the brain is connected with the local accident.

It so complicates and imperils life that, during the Crimean war, the surgeons were restrained from amputations. The young surgical assistants were absolutely forbidden to touch the frozen parts with the knife.

It is manifest, then, that the brain must be first appeased before local treatment can avail. In the Austro-Hungarian expedition, Payer states that collodion, with iodine, was often of great use as a local application.

We would infer, though having no conclusive experiment, that magneto-electricity would serve to reanimate the failing nervous system.

An induced current passed through the brain and spinal axis might supply new energy, while, as a local stimulus, it would revive languishing granulation in frost-bite ulcerations, promote cicatrization and appease, perhaps, the excruciating neuralgia of the sores.

Should the electric light be employed on the Bennett Expedition, a diverted current might be passed through an apparatus to reduce intensity, and be thus utilized as an hygienic appliance.

We would further indicate the fluid extract of malt, associated with the hypophosphite salts, condensed milk and compressed coffee.

The new antiseptic, borate of soda and potassa, to preserve meats, fish, etc., will be an invaluable acquisition.

Who shall own these vast possessions? Who owns them now?

At present, all explorers, all nations, are pleased to penetrate the vast embattlements which mark and guard the Pole, the floes, the bergs, the hummocked crushing masses, "old ice" on one side, "new ice" on the other, dense fog, ice below, snow above, the northern blast, the unconquerable glacier—and who shall win the first discovery, "so longingly coveted?" But all are too happy to escape with their lives therefrom, and be welcomed again to the genial home.

Already on cape, sound, strait, and bay, on every "land" floats the possessory banner of a nation. Should a climatic revolution suddenly restore to fertility and civilization, warmed with tropical temperature, what would not be the contests in International Congress to fix the frontiers! History would repeat itself. The autochthones would be ignored. The native proprietor, whose favor we now court with trivial presents, would be again despoiled—whose furs, dogs, sledges, we now purchase with paltry bribes or insignificant tools for their simple industry, would be assigned to reservations, with Indian Agents for their Great Father.

The walls of China have been overridden and the nation forced from its seclusion, now again to be driven back within its broken parapets. In like manner will the feeble but indispensable Esquimaux be first courted with bribes, caressed, and then of his ice-girdled home be dispossessed.

We can but say, such is mankind; such the human race. "Such," exclaims Burke, "is the mode of existence decreed to a permanent body composed of transitory parts wherein, by the disposition of a stupendous wisdom, moulding together the great mysterious incorporation of the human race, the whole at one time is never old, nor middle aged, nor young, but in a condition of unchangeable constancy, moves on through the varied tenor of perpetual decay—fall, renovation and progression."

Evolution and involution succeed each other in their eternal orbit.

As Pioneers of Science in this "Western land," we can only exclaim to our proposed expeditions, the daring pioneers of the Arctic Zone, while we wave to them in farewell the banner of our country, hoping again to run it to the peak to salute their safe return, "GOD SPEED THEE!" and impress on their mind our favorite motto, with Liberty presiding over the two Americas, "*Hæc sit Patria Nostra!*"

Dr. Harkness then introduced Lieut. DeLong, the commander of the expedition, to the audience, who was received with much applause, and who spoke as follows:

"When the officers of this expedition were invited to attend this meeting, I answered that nothing would give us greater pleasure, but we hoped to be excused from taking any part in the discussions until after our return from the Arctic

regions. This amiable peculiarity of ours, it seems, is not to be tolerated, however unfit I am to reply with any degree of propriety to the very kind expression of your wishes. As for this particular expedition, there is nothing much to say. It has been made possible by the liberality and enterprise of a single individual, and he has placed it in charge of officers of the Navy, and by an Act of Congress it has been awarded official sanction. It is peculiar in another way, for it is the first attempt to reach the North Pole by going through Behring's Straits. Other vessels and expeditions for the relief of Sir John Franklin have gone through this Strait, but this will be the first practical Arctic Expedition to attempt this route toward the Pole. We expect to undergo the same trials and embarrassments as other polar expeditions have met with.

"We shall begin our work at the 71st parallel of latitude. Beyond this, all is unknown, and we shall first determine whether there is land, ice or sea. You will excuse us from further outlining our work until our return, when nothing will give us more pleasure than to tell you what we have done."

Dr. F. Baer, J. P. Moore, Chas. W. Brooks, Wm. Bradford, on the part of the Academy, and Jerome J. Collins, a member of the Expedition, also spoke on the occasion, after which the meeting adjourned.

A REMARKABLE BILL!

A Bill to authorize and promote international inquiry and conference as to the practicibility of extending the channels of the Bay of Fundy and of the Mississippi River to and through Hudson's Bay, introduced by Mr. Blair.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War is hereby authorized and directed to cause and invite a preliminary inquiry and survey into the practicability and probable results and costs of the following proposed changes and improvements in certain rivers and seas of North America, and to report to Congress at as early a time as practicable the results of such inquiry and survey.

And it is hereby ordained and provided, That the subjects of inquiries and surveys and conferences in pursuance of this act shall be in detail as here follows, and shall be considered under the methods hereinafter described:

To extend the channel of the Bay of Fundy to and through the Gulf of Saint Lawrence and through Labrador to Hudson's Bay; to extend the channel of the Mississippi, and compel a flow of the thermal water of the Gulf of Mexico through such channel or channels into Hudson's Bay; to conduct the watershed and tidal currents to and through Hudson's Bay, as a thermal flood, to make that bay an inland thermal sea, with the purpose of ameliorating and equalizing the climate of the whole continent; to obtain by these north-going thermal waters "a warm inshore current," and the opening to commerce of the Northwest Passage and of other channels now closed by ice; to give to the Lower Mississippi, from

the Gulf to the greatest practicable inland distance, a constant sea-level, thus preventing inundations and consequent epidemics; to select locations for the formation of inland lakes of sufficient area to detain the waters of the upper affluents, and thus protect our rivers from freshets and from shoals.

METEOROLOGY.

PARADOXICAL PHENOMENA IN ICE CAVES.

J. RITCHIE, JR., BOSTON, MASS.

[Concluded from July Number.]

The theory suggested in the same report, page 207, is one of non-conduction and is more general, depending in part upon the absence of subterranean water courses and ascending streams of warm air.

Last, comes the theory advanced by Mr. Browne, which he states to have been independently deduced by himself and by M. M. J. LeDuc, and is, "that the heavy, cold air of winter sinks down into the *glacieres*, and the lighter, warm air of summer cannot, on ordinary principles of gravity, dislodge it, so that heat is very slowly spread in the caves, and even when some amount of heat does reach the ice, the latter melts but slowly, for ice absorbs 60° cen. of heat in melting; and thus when ice is once formed it becomes a material guarantee for the permanence of cold in the cave." In the arguments adduced to support his theory, there is not one that is not unquestionably an aid to the preservation of cold in the caves, and is undoubtedly the real agent in the case of some, at least, of the caves he describes. Allowing, then, that his theory does cover the cases of all the caves of which he has been an explorer—for a discussion on this point would be not of the slightest importance as regards Mr. Lowe's theory—there remain still, as acknowledged by Mr. Browne, the caves in which it is impossible wholly to disregard the popular belief that thaw does occur in winter. In this case, Mr. Browne admits that his theory will not be adequate; and, at the same time, he does not express himself as satisfied with any of the other theories as yet advanced. That of Mr. Scrope he mentions as perhaps being to the point, but seems doubtful, indeed, as to whether it is sufficient. The theory of Mr. Scrope is specially adapted to those caves which occur only in basaltic or volcanic formations, and presupposes a connection of the cavern with the outer air at some other level, thus giving a circulation, as is known to be the case in mines. This passage, according to Mr. Scrope, may to a certain extent be a dessicating tube,

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owing to the sulphuric or muriatic acid held by the porous, volcanic rock, and the air, completely deprived of its moisture, seizes that of the water and thus freezes it from its own evaporation. These assumptions may not be altogether improbable in the caves of a volcanic stratum; but in the case of the cave of Illetzkaya, which is in gypsum, or that of our own cave of Decorah, which is limestone, and unquestionably has no other opening (save a small fissure), how can the phenomena be explained? Evidently the theory of Mr. Browne is by his own statement inadequate, while that of Mr. Scrope lacks two of the most important elements.

That the explanation of Mr. Lowe completely supplies the lacking elements, seems the more reasonable the more research and thought we give to the subject. That its action is simple, as are all the actions of nature, is an argument in its favor. That it has not been before thought of, is perhaps curious, but at the same time, the fact is that the real action of the compression of air by the Frizzel air compressor, or by the tromp (for the explanation of which latter see "tromp" in almost any mechanical dictionary), has not until lately been known, and, although the result has long been acknowledged, still the process was not traced out until the researches of Mr. Frizzel. This, then, may be considered as a principal reason why such an explanation has not been sooner advanced.

It does not, then, admit of the slightest question but that air brought down from a height by streams of water, will in its descent be subject to constantly increasing pressure. In his treatise on heat, Boz states directly, that "if compressed air be deprived by cold water, or by other means, of the heat developed by its compression, and then suffered to return to its normal volume by relief of the pressure, a very low temperature is obtained." It is also well known that a stream of water flowing through fissures in rock, will be kept at the temperature of the rock. In speaking of the ice well at Oswego, New York, Silliman states in his Journal (xxxvi, 184), that he would be well pleased to be able to account for the phenomena in this connection, and further says, "Could we suppose that compressed gases, or a greatly compressed atmosphere were escaping from the water or near it, this would indicate a source of cold," but he could find no indication of this nor any reason for the compression.

Combining the facts above given, as has been done by Mr. Lowe, the cause and effect, so far as regards ice caves, may be readily traced. The cave at Decorah appears to be peculiar in one feature—the perfection of its action; and in it the absence of other aperture, and of volcanic rocks, present problems that are solved with extreme difficulty by any of the previously announced theories. There do not exist in caves good conditions for evaporation, yet, for the most part, the air in them is of the best, and the circulation, produced by the same means as the freezing, is perhaps a thing to be considered. The liberation of compressed air, then, in caves, may give rise to a variety of phenomena. There may be freezing in winter, provided mingled air and water can reach the cave; there may, and probably will be, freezing in summer, or at the time of the greatest rains, for then mingled air and water do find their way to the cave; there may be freezing

all the time, for the conditions necessary for a constant supply of air and water are not difficult to imagine nor unreasonable; there may be no freezing, but simply a current of cold air; one or all of a series of caves, which have heretofore been considered as precisely of the same nature (for example, Illetzkaya), may, in some cases, present some or all of the phenomena, or none. It seems to be the first reasonable explanation, which does, from its very simplicity, cover all the cases of the kind.

That the facts collected by Mr. Browne are justly stated, and in some or perhaps all of the instances quoted by him, will fulfill the requirements of the case, is reasonable enough; but there is, we should judge, a fulfillment in nearly every case, of the simple requirements of Mr. Lowe's theory, and it is highly probable that his explanation and that of Mr. Browne go hand in hand so far as the latter desires to carry his theory, but then facts that do not support the Browne theory will be found to well support Mr. Lowe's. The inclination of the entrance to the caves has been sufficiently discussed by Mr. Brown, and it is not necessary to more than allude to it, while the presence of a snow slope in the inclined entrance would be evidence of a dual phenomenon, the snow being the remains of the previous winter's fall.

In the majority of the caves, direct mention is made of the means by which the water reaches the cavern; and in the main the freezing may be directly traced to this source. Generally fissures can be found. In Decorah, mention is made of a fissure, and the description is so exact, even when compared with the conflicting statements in *White's Geology of Iowa* (i, 80), as to be worthy of some credence. In a number of the caves of Mr. Browne, fissures are mentioned, and generally as the source of an ice pillar. In the *glaciere* of Monthezy, domes are mentioned, filled on the interior and sides with ice; while in the cave of Illetzkaya, an old fissure in the hill was mentioned by Pallas (*Voyages*) as existing long ago, but now no mention is made of it; while in Pictet's account of the Neidermendig quarry (*Mem. Geneva*, i, 75), the formation of ice in this way is mentioned. Mine shafts, both in Sweden and in Russia, and at Port Henry, near Lake Champlain, New York, exhibit phenomena of this nature; in all cases the ice forming at a considerable distance below the top of the shaft. Mr. J. C. Ward, in *Nature*, xi, 310, mentions a temporary ice cave in a mine in Cumberland, England, but the phenomenon there is of rare occurrence.

A parallel case to the cave at Decorah, at least so far as can be judged from the description, exists in the Val d' Hérens, near Evolena, and is mentioned in *Nature*, xi, 327; the similarity may be, however, merely in form and not in phenomena.

The liberation of compressed air in a cavern may or may not produce a perceptible current within or at the mouth of the cave. When the quantity of air brought down is large in proportion to the size of the cave, perceptible currents may ensue; and, from the description given in the *Scientific American*, such might reasonably be expected to be the case at Decorah, White's statement to the con-

trary notwithstanding; and it may not be too bold to claim that a portion of the air in circulation in caves, whether ice caves, cold or blowing caves, stalactitic, or ordinary caves, may be due to the liberation of compressed air, and the agency of the latter may perhaps be traced in still others of the phenomena of caves.

The formation of stalactites and stalagmites themselves may be due in part, at least, to the same cause; and it is necessary merely to assume that the stream containing the compressed air is at the same time saturated, or nearly saturated, with mineral matter, and it will, when lowered in temperature, lose some proportion of its solvent power.

The question of the agency of compressed air and gas in the solution of natural phenomena, has received but little consideration as year, and it would seem to widen the field a little for experiment; and while its proof is a matter that requires more facts and special investigation, it would hardly seem proper to condemn it without due and lengthy consideration.

In conclusion, then, it may be seen that some of the elements of Mr. Lowe's theory have already been advanced, and by able scientists:—the possible effect of compressed air, by the elder Silliman; the effect of surface frost as modifying the water supply, by Mr. Hope (*Ed. Phil. Jour.*, xxxv, 192); the possibility of air bubbles being imprisoned in a stream of descending water, by Mr. J. T. W. Johnston, in a paper before the Royal Society of England,—all have been steps toward the solution of the problem of the formation of ice in ice caves, but to Mr. Lowe must be rendered the honor of tracing the relationship between cause and effect, and even should it in some cases apparently fail to explain fully the phenomena, still it is undoubtedly a step in the right direction, and should it even have no greater effect than the collection of data and observations on the subject, its value even then would be great.

It was our intention, and we had prepared for publication, a list of the known ice caves, with their peculiar features, for the purpose of comparison with this and with other theories, but, for obvious reasons, it must be delayed until another issue, together with explanations of other natural phenomena.—*Science Observer.*

KANSAS WEATHER REPORT FOR JUNE, 1879.

BY PROF. F. H. SNOW, OF THE STATE UNIVERSITY.

Mean temperature, 73.22 degrees, which is 0.77 degrees below the June average for the eleven preceding years. Highest temperature, 97 degrees, on the 9th; lowest, 45 degrees, on the 2d; range of temperature, 52 degrees. The mercury reached or exceeded 90 degrees on 12 days. In June, 1878, it did not once reach 90 degrees. Mean temperature at 7 a. m., 68.30 degrees; at 2 p. m., 83.20 degrees; at 9 p. m., 70.78 degrees.

Rainfall, 7.14 inches, which is 1.92 inches above the June average. Rain fell on 13 days; there were 9 thunder showers, two of which brought a small amount

of hail. The storm from 5 to 6 p. m., on the 9th, was very severe, the wind reaching a velocity of 60 miles an hour, and unroofing several buildings in the city of Lawrence and vicinity.

Mean cloudiness, 41.33 per cent of the sky, the month being of the average cloudiness. Number of clear days, 12, (entirely clear, 2); half-clear, 13; cloudy, 4, (entirely cloudy, 3). Mean cloudiness at 7 a. m., 43.67 per cent; at 2 p. m., 49 per cent; at 9 p. m., 31,33 per cent.

Wind.—S. E., 28 times; S. W., 23 times; N. W., 14 times; S., 7 times; E., 7 times; N., 4 times; N. E., 4 times; W., 3 times. The entire distance traveled by the wind was 0,498 miles, which gives a mean daily velocity of 316.60 miles, and a mean hourly velocity of 13.19 miles. The highest velocity was 60 miles an hour on the 9th.

Mean height of barometer, 29.040 inches; at 7 a. m., 29.077 inches; at 2 p. m., 29.005 inches; at 9 p. m., 20.032 inches; maximum, 29.417 inches, on the 2d; minimum, 28.675 inches, on the 14th; monthly range, 0.742 inches.

Relative Humidity.—Mean for the month, 69.9; at 7 a. m , 77 9; at 2 p. m. 55.78; at 9 p. m., 76.06; greatest, 100, on the 26th; least, 21.5, on the 3d, There was no fog.

MISSOURI WEATHER SERVICE, JUNE, 1879.

BY F. E. NIPHER, WASHINGTON UNIVERSITY, ST. LOUIS, MO.

The temperature of this month has been below the normal, the monthly mean at the Central Station being 73.6°, or 1.1° below the average of 42 years. The extremes were 93° and 49.5°. In 1870 a maximum of 101.5° was observed and in 1838 and '39 the minimum reached 43°. The rainfall was 3.86 inches. A deficiency of about 0.39 inches. The total deficiency for the past six months of 1879 is 9.58 inches. The month has been remarkable for the distribution of the rainfall, as the accompanying map shows. The greatest precipitation occurred at Miami, and the fall diminished rapidly toward the west, south and east. The rainfall at Macon was but 5.56 inches; the observer there reports that on the 26th 0.23 inches only were recorded, while at a distance of three miles very heavy showers fell. Heavy local storms occurred at Centerville and Ironton on the 1st, and at Greenfield on the 23d, 24th and 25th. The heaviest single rain is reported from Lexington, 3.35 inches falling in nine hours. Several thunder storms are reported from the eastern and southeastern districts on the first, from the central, northwestern, southwestern and eastern districts on the 13th and 14th, and especially from the northern and western districts during the last decade, although heavy rains were observed throughout the State between the 22d and 29th almost daily. At Oregon, on the 13th, a storm destroyed a brick church, and carried the roof a distance of 200 yards; many bridges in the county were washed away. A Mexico, a thunderstorm on the 24th, accompanied by hail, destroyed trees,

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and carried a 1½ story house 60 feet destroying it entirely. An aurora was seen at Boonville on the 18th. Notwithstanding the protracted dryness in the north-eastern patt of the State, the crop reports from that section are more favorable than during last month; peaches and apples are poor. Good crops are reported from the eastern and central districts.

METEOROLOGICAL SUMMARY FOR JUNE, 1879.

SIGNAL OFFICE, LEAVENWORTH, KANSAS, JULY 1, 1879.

The past month was noticeable for the high mean temperature, severe local and frequent thunder storms and heavy rainfall.

The mean barometer of the month was 29.871, which was slightly above the June mean. It was the highest June mean since 1872, when it was 29.910. The daily ranges during the month were very slight. The highest reading during the month was 30.288, on the 2d; the lowest 29.456, on the 14th.

The mean temperature of the month was 73.35°, just one degree below the normal. The highest temperature of the month was 93°, on the 9th; the lowest 46°, on the 2d. The mean and maximum were each about 2° above the mean and maximum of June, 1878. The greatest daily range was 32° on the 3d; least daily range 4.5°, on the 25th.

The mean percentage of humidity was 66.28. The average is 65.95%. The greatest daily mean was 84.3%, on the 22d and 27th; the least daily mean 39.3%, on the 4th.

The total rainfall during the month was 9.90 inches. With the exception of June, 1877, (the total that month was 10.00 inches) this was the heaviest June rainfall in eleven years past. The amount which fell on the 27th was 3.43 inches, which was unprecedented in the records of the Station. The June average is 5.38 inches. The annual average of the past 7 years has been 38.50 inches.

The prevailing wind of the month was south. Total number of miles traveled, 5,752. Highest velocity, 48 miles, from the south at 7 p. m., 9th. The direction of the wind was recorded 210 times as follows: N., 29 times; N. W., 19 times; W., 7 times; S. W., 5 times; S., 63 times; S. E., 60 times; E., 18 times; N. E., 4 times, and calm, 5 times.

Number of clear days, 3; fair days, 18; cloudy days, 8, and days on which rain fell, 13. There were 10 thunder storms during the month.

A well-defined solar halo was observed on the 30th, at 11 a. m.

The following extracts are given as being of interest at present. Dr. Tiffin Sinks, in a "Report on the Climatology of Kansas," published in 1866, states that, "The June mean temperature at Fort Leavenworth, compiled from observations extending over a period of thirty years, was 71.31°. The mean of the summer months was 74.05°. The highest temperature ever observed in that time was 108°; the lowest, —30°."

"The average annual rainfall for 30 years was 31.34 inches. Average of summer months, 13.03 inches. The June average is not given. The greatest amount of rainfall observed in one year was 59 inches, in 1858; the least amount in one year, 16 inches, in 1843. The total amount that fell during the summer months of 1854 (the year of the great drought) was 5.70 inches."

In the Kansas Magazine for June, 1873, Prof. F. Hawn, in an article on "Influence of Forests on Climate," says:

"In each year since 1865 the rainfall exceeded the mean of 34 years. The annual mean of the 7 years since 1865 was about 36.50 inches, yet this increase has not extended to the winter, with the snow water included."

"It should not, however, be overlooked that the period in which this excess has accrued is too short to give a definite expression of the results, as we may be on a cycle favorable to the production of increased rains, which may soon close."

"The rain line in Kansas is moving westward, the result of physical causes and the order of natural selection, extending a more exuberant vegetation over the eastern margin of the great arid plains."

"The total rainfall of June, 1868, was 3.76 inches.
" " " " 1869, " 5.10 "
" " " " 1870, " 3.57 "
" " " " 1871, " 5.90 "

The following table shows the mean barometer, temperature and humidity, total rainfall, maximum and minimum temperatures and highest and lowest barometer of June for the past seven years, also the June averages for the same period:

Year.	Mean Barometer.	Mean Thermometer	Mean Humidity.	Total Rainfall.	Maximum Temperature.	Minimum Temperature.	Highest Barometer.	Lowest Barometer.
. . . . .		deg's.	per c't.	inches.	deg's.	deg's.		. . .
1872	29.910	77.25	60.74	4.75	95	60	30.360	29.320
1873	29.840	75.50	67.20	3.15	97	57	30.107	29.540
1874	29.843	77.40	69.50	4.96	96	50	30.185	29.489
1875	29.851	76.70	58.80	3.85	99	48	30.215	29.480
1876	29.831	71.20	66.00	5.71	95	46	30.130	29.472
1877	29.828	71.90	70.10	10.00	93	45	30.067	29.431
1878	29.863	71.50	69.30	5.27	91	49	30.151	29.510
1879	29.871	73.35	66.28	9.90	93	46	30.288	29.456
Average of 7 Years.	29.852	74.35	65.95	*5.38	95	51	30.174	29.463

*By adding the observations of Prof. Hawn from 1868 to 1871, inclusive, the June average is reduced to 5.09 inches.

Samuel W. Rhode,
Signal Corps, U. S. A.

WEATHER REPORT, SUMMIT, COLORADO, JUNE, 1870.

BY PROF. C. B. ROBINS, V. O.

Highest temperature, 62+°; lowest temperature, 28+°; mean temperature, 42.6+°; mean of maximum temperatures, 55.1+°; mean of minimum temperatures, 35.9+°; total snowfall, one-half inch; rainfall on three days, not enough to measure in gauge; prevailing wind, west; maximum velocity of wind 20 miles an hour; number of days on which snow fell, 3; number of cloudy days, 3; number of fair days, 4, number of clear days, 23. June 24th, first rainfall of 1879, mingled with snow. June 16th, snow from cloudless sky.

During most of the month the atmosphere has been filled with smoke and ashes from two extensive forest fires west and southwest of us, and from ten to twenty-five miles distant. The conflagration west is advancing rapidly this way under a strong gale, but as two mountain ranges with summits above timber line intervene, no apprehension is felt here. These fires have been burning continuously for two months, the amount of timber destroyed is very large. Everything is exceedingly dry.

COMPARATIVE SNOWFALL DURING WINTERS OF 1876–7, 1877–8 AND 1878–9, AT SUMMIT, COLORADO.

1st September, 1876, to 1st July, 1877 . . . . . 235.67 inches.
1st September, 1877, to 1st July, 1878 . . . . . 245.82 "
1st September, 1878, to 1st July, 1879 . . . . . 148.68 "

The snowfall in 1878–9 was less than in 1876–7 by 137 inches, and less than that in 1877–8 by 97.14 inches; or, 52% of that in 1876–7, and 62½% of that in 1877–8 = 56% of that in the two previoas years averaged, or 44% below their average.

GEOLOGY AND PALÆONTOLOGY.

ANOTHER VIEW OF THE ANTIQUITY OF MAN.

BY PROF. B. F. MUDGE, MANHATTAN, KANSAS.

We were much interested with the article in the June number of the REVIEW, on the Antiquity of Man, by the Rev. J. L. Templin. He has very clearly and fairly stated the facts in the case, though we think he has left the question of the age of our race, in years, too indefinite.

We agree with him (and Dana) that man was on earth "at the close of the glacial epoch, that he witnessed the retreat of the glaciers from Central Europe,"

etc., etc. After the glacial epoch, geologists fix three distinct epochs, viz: the Champlain, terrace and delta, which have been considered of nearly equal lengths. The question then arises, have we no evidence to show the length of either of these periods?

There are facts which circumstantially give us a near approximation of the age of each, but they are nearly all based on considerations which only an expert geologist can appreciate. There are, however, in the delta period of the Mississippi, proofs which will give a very close approximation, in years, to the length of that epoch.

Various estimates have formerly been made for the time of the delta period, with varied results, Lyell and others placing it at least at 100,000 years, and others making it less. Farther researches, extensively made, have confirmed Lyell's estimate. The most reliable evidence is as follows: For a distance of about two hundred miles of the delta are seen distinct forest growths of large trees, one over the other, with interspaces of sand; showing distinct periods of the entire destruction of the forests; and after burial, again a new generation of trees over the others. There are ten of these distinct forest growths, which have begun and ended, one after the other. The outstretched, undisturbed position of the roots of the trees, as well as the other conditions of the deposits, show that they were not washed in, but grew on the spot.

Now if we can fix the time occupied by the life of these trees, we can give, at least, an approximate result. Fortunately the data are clear and can be studied by any person of ordinary intelligence. The trees in question are the bald cypress (*Taxodium*) of the Southern States, one of the largest and longest of life of the world's trees. Specimens cut down in the present age are known to be from 5,000 to 7,000 years old. Humboldt saw one in Mexico of extremely large size, which he estimated—from counting the rings of smaller trees of the same species—to be eight thousand (8,000) years old.

Such are the trees found in these old, buried forests of the delta of the Mississippi. Some of the old trunks were over twenty-five feet in diameter. One contained over 5,700 annual rings. In many instances these hugh trees have grown over the stumps or fallen trunks of others equally large. Such instances occur in all, or nearly all, of the ten forest beds. Dr. Dowler, one of the best physicians and scientists of New Orleans, saw such instances in many places, and concluded that each of the ten forest growths contained, on the average, two such trees of 5,000 years each, living in succession. This gives to each forest a period of 10,000 years. Ten such periods give 100,000 years, without considering the time covered by the intervals between the ending of one forest and the beginning of another. The thickness of the intervening sand shows that this interval was not, in most cases, a short one.

Such evidence would be received in any court of law as sound and satisfactory, where common sense evidence is used. We do not see how such proof is to be discarded when applied to the antiquity of our race. If the antiquity of the mas-

todon was in discussion no one would doubt it. Human bones have been found in the fifth forest bed, and stone implemenis still lower. As Rev. Mr. Templin has stated, there is satisfactory evidence that man lived in the Champlain epoch. But the terrace epoch, or the greater part of it, intervenes between the Champlain and delta epochs, thus adding to my 100,000 years. If only as much time is given to both those epochs combined as to the delta period, 200,000 years is the total result.

There are other evidences in Europe, generally clear to the geologist, which sustain this long time for the antiquity of man.

ARE BIRDS DERIVED FROM DINOSAURS?

PROF. B. F. MUDGE, MANHATTAN, KANSAS.

We hear, repeatedly, that the Dinosaurs are the ancestors of birds, or the stock from which the latter have been derived by evolution. A few points of resemblance, first noted many years ago, have been constantly repeated, without considering the numerous other points of dissimilarity which a more thorough knowledge of new genera and species has afforded. The fact that the bones of the hind feet of a few species closely resemble those of birds, and some of the bones were hollow, gave rise to the hasty conclusion that other resemblances would be found, and that the bird was the outgrowth of the reptile. While a few foreign species have three toes, like the bird, some of the European and nearly all of the American, have four and five toes, and the structure, and number of bones to the toe are closely reptilian. When there is a divergence from the reptilian type the feet approach the mammalian structure more than that of birds. This is seen in the numerous species and genera of the Sauropoda. In all cases, also, where there are but three toes, and those in structure are like the birds, the other bones of the foot and leg do not approach the type of the birds. When four toes are seen in the dinosaur, the fourth never turns backward like that of the bird. That most characteristic bone in the bird—the tarso-metatarsus—is, in the dinosaur, represented by the usual number characteristic of the reptiles, namely, five to eight bones instead of one; and in no case is there a tendency to consolidate. The tibia and fibula of birds are consolidated, while in the dinosaurs these bones are always separate.

It will be seen that if the legs of the dinosaur tended to a development toward the bird structure, this development is not harmonious, as it should have been; but in the few cases where the toes are bird-like, the other bones of the foot and leg show no such tendency.

Following the structure of the skeleton further, we find the pelvic bones of the bird always consolidated; those of the dinosaur never. Except in a few cases these bones are very different in shape. The termination of the caudal vertebra of the dinosaur is always small and does not tend toward the plowshare structure of the birds.

A still more marked feature is the want of approximation of the dinosaur to the bird, in the sternum or breast-bone. This, in the bird, is the bone more than any other, which is mostly enlarged and singularly developed. Even in the ostrich and fossil Hesperornis, and other birds without wings, it is a large, massive bone. But in the thirty-five or more genera, embracing more than twice that number of species, of dinosaurs, only two have any trace of a sternum, even cartilaginous. In one European and one American species there is a small, slender, flat sternum, entirely unlike that seen in the bird, very reptilian in its structure. It has no shape that can be simulated to that of the bird. As a necessary result the clavicle (*furculum*), so marked in birds, is also wanting, though a rudimentary one is inferred in Apatosaurus

The differences between the wing bones and those of the front feet of the dinosaur are as marked as in any other portion of the skeleton. If the one had been the outgrowth of the other, then we should have seen an early and more rapid change in the fore foot of the reptile, than in the hind foot, inasmuch as the wing is far different in shape from the foot. But when the dinosaur has but three toes, like a bird, in the hind foot, (losing two from the typical reptile foot,) the fore foot has four toes. When the dinosaur has four toes in the hind foot, there are five in the front foot, all clinging to the reptilian type, and showing no divergence in the shape or structure toward the two closely united fingers of the wing. If the bird were a descendant, by evolution, from the dinosaur, the change of a foot to a wing should have begun early, and the development should have been more marked and rapid than that of the hind foot. But no indications of such change is seen, or the slightest tendency to form a wing, in all the fifty or sixty species of dinosaurs that have been described.

The hollowness of the bones is less a marked feature of the dinosaurs than is usually supposed, and cannot be considered a marked characteristic; as more than half of the genera have no pneumatic cavities like birds, but bones of the solid or medullary structure of mammals. In Camarasaurus of Cope the hollow chambers assume a singular structure entirely unlike that of birds. The long bones are solid or medullary; but the vertebræ, which in birds are solid, have open re-entering cavities, which add lightness and strength, and may have been pneumatic. But the hollowness, such as it is, has no resemblance to that of the long bones of birds.

The articulations of the vertebræ, when not retaining the reptilian traits, are more like mammals than birds. The bird articulation, so peculiar and so persistent, sometimes called "saddle-shaped," is not found in any dinosaur. But in the fossil Ichthyornis (first discovered by the writer in Kansas), a bird in this respect of low type, the vertebræ do not approach any form peculiar to the dinosaurs, but are fish shaped, or bi-concave.

It will thus be seen that, while in a few features there may be some resemblances between dinosaurs and birds, just as there are between the former and mammals, the details of the structure of the skeletons show, as a whole, very wide-

ly different elements. The dinosaurs vary so much from each other that it is difficult to give a single trait that runs through the whole. But no single genus, or set of genera, have many features in common with the birds, or a single persistent, typical element of structure which is found in both.

The geological position of the dinosaurs, too, precludes the idea that they are the ancestors of the birds. They appear at the same time (in the Triassic) as the birds, instead of preceding them, and they continue to the Eocene; and the later specimens do not approximate any nearer to bird forms than the first.

If the birds were derived, by process of evolution, from the dinosaurs, then the latter should have appeared first, and, as geological time progressed, should, harmoniously, in every organ, assume a nearer and nearer approach to the bird type, and finally disappear in the flying biped. When it became a bird, it should have ceased to be a Dinosaur, just as a child disappears in the man. The last one at the close of the Cretaceous, when the type became extinct, had no nearer an approach to the bird than the earliest in the Triassic. Laosaurus, which, of all the twenty-seven American genera, approaches in the toes and pelvis nearest to birds, is found in the Wealden; and, in legs, fore feet, and absent sternum, has no approximation to a bird.

No dinosaur has ever shown a fore foot approximating in the slightest degree to a wing. The first bird was as distinctly a bird, with feathers and wings, as any now living. True, Archæopteryx had a tail of twenty vertebræ, but that is an appendage in common with the lowest reptile and the monkey, and does not ally it to the dinosaurs any more than to those animals. The fossil birds differed as strongly from each other as those now living. The Hesperornis and Ichthyornis lived and ran out together, the one without wings and with a common bird vertebræ; the other with strong wings and a fish-like vertebra. Others lived with them closely allied to living species.

With so little to sustain the evolution of the bird from the dinosaur, can it be accepted as a geological fact?

ASTRONOMY.

OBSERVATIONS OF SWIFT'S COMET, 1879.

PROF. S. C. CHANDLER, JR., BOSTON, MASS.

I herewith send you observations, with elements and an ephemeris, of the comet discovered by Lewis Swift on June 19. The comet was observed by me on four evenings; on two of these good determinations of position were obtained with a ring micrometer on a 3-inch Clark refractor. On the other evenings the

best I could do was to make careful allineations of the comet with the telescopic stars in the field; and a careful reduction of these has furnished positions which are probably less than a minute of arc in error. I append them with the micrometer observations, as they may prove to have some value.

Boston Mean Time.	Apparent Place. A. R.	Decl.	
d. h. m. s.	h. m. s.	° ′ ″	
June 25 10 15	2 49 40	+68 50	By allineation.
26 13 49 12	50 19.7	+69 59 8.2	3 obs. with ring microm.
27 12 20	50 46	+71 1	By allineation.
30 14 22 12	52 30.7	+74 21 10.6	3 obs. with ring microm.

In these observations I was kindly assisted by Mr. J. C. Howard.

From the above positions of the 26th and 30th, combined with one made on the 23d by Prof. Hough, at Chicago, as follows:

June 23d, 11h. 47m. 0s A. R 2h. 48m. 43.6s Decl. +66° 50′ 54″,

I have calculated the orbit, and I append the elements, and also a finding ephemeris.

Elements.

Perihelion Passage, 1879, May 20.2115. Washington Mean Time.

	°	′	″	
Long. Perihelion,	11	35	25	} Mean Eq. 1879.0.
Long. Node,	56	4	0	
Inclination,	70	38	3	

Log. Perihelion Distance, 0.09482.

Motion, Retrograde.

The orbit does not resemble that of any known comet.

Ephemeris for Washington, Midnight.

1879.	A. R.	Decl.	log. r.	log. $\triangle$
	h. m. s.	° ′		
July 7.	2 57 20	+82 23		
9	58 57	84 49	0.1644	0.1905
11.	3 2 25	87 18		
13.	4 5 30	89 48	0.1737	0.1860
15.	14 54 0	87 39		
17.	14 58 11	85 6	0.1833	0.1839
19.	15 0 0	+82 31		
21.	2 3	79 56	0.1930	0.1844
23.	3 29	77 21		
25.	4 55	74 47	0.2028	0.1877
27.	6 20	72 14		
29.	7 47	69 42	0.2126	0.1935
31.	9 10	67 14		
Aug. 2.	10 33	64 45	0.2225	0.2019

Between the 13th and 14th of July the comet will pass nearly over the celes-

tial pole, which is the cause of the abrupt change of about 12 hours in right ascension in the ephemeris.

Although the comet will slowly approach the earth until the 17th of July, it will become no brighter, since it is receding from the sun more rapidly. The relative brightness, as indicated by the reciprocal of the square of the product of the distances from the sun and earth, is as follows:

June 19,	1.90.	July 17,	1.84.
25,	1 95.	25,	1.66.
July 1,	1.98.	Aug. 2,	1.42.
9,	1.95.		

Although easily seen with 3 inches aperture, the comet is difficult to observe with the micrometer on a telescope of that size. It has an oval disc about 5 minutes of an arc in diameter, and its light is considerably condensed toward the center.

It may save computers trouble to mention an error in the *American Ephemeris* for 1879, p. 393; sun's true longitude for July 1.0, minute should be 25, not 26

—[*Science Observer.*

VISIBILITY OF THE CORONA IN FULL SUNLIGHT.

PROF. ORMOND STONE, CINCINNATI OBSERVATORY.

I have been much interested in the discussion which took place at the March meeting of the Royal Astronomical Society in regard to the visibility of the corona. In this connection permit me to say that Mr. Upton, who observed the late eclipse of the sun with me at Schuyler, near Denver, Colorado, saw the moon's limb five minutes eight seconds before the beginning, and seven minutes and thirteen seconds after the end of totality. I myself saw the coronal rays distinctly for twenty-three seconds after totality had ended. A flood of light then suddenly filled the field of my telescope, and the rays could be no longer distinguished, although the moon's limb was sharply defined. I have no doubt that if I had moved the telescope so as to throw the limb of the moon to the edge of the field I should not have been disturbed so soon by the sunlight, and might have seen the coronal rays at least some seconds longer.—*London Observatary.*

POLITICAL SCIENCE.

BRITISH IMPERIALISM AND THE AUTONOMOUS RIGHTS OF RACES.

BY A. H. THOMPSON, TOPEKA, KANSAS.

With the advent of the present year the civilized world was again summoned to the contemplation of, and, if charitably minded, to applaud and sanction, the exhibition of a fresh sample of British Imperialism, in the descent upon Zululand. The actual occasion of this war appears to have been the growth of the South African Empire, the demand for more land making it expedient to take and annex more territory; cause for quarrel with neighboring native nations being easily made, and war being inevitably followed by conquest and annexation.

In commenting upon the disaster to British arms with which the campaign against King Cetywayo and the Zulus was inaugurated, the *Times* states that Lord Beaconsfield "is avowedly devoted to what is now well known as 'Imperialism,' that is to say, to a system under which the people are to submit to a course of secret policy directed to objects of conquest and aggrandizement few of them would approve," and the actions and policy of the Tory Premier and his tools, his "Jingoism" and his "Jingos" are roundly censured. But we outsiders, having "cut loose" from the Mother Country, and pursuing a path of action and thought essentially free and original, have little sympathy with British party jealousies and asymetrical patriotism, and the conventional differences between the "ins" and the "outs." To us it has appeared as if the English nation has pursued this same policy under any and every administration; that the conquest and enslavement of weak peoples has been an hereditary policy for centuries, whether under Tory or Liberal government. In the case of the doomed Zulus the purpose of attack was ill-concealed, though cloaked under a cause and quarrel itself purposely provoked and created.

In view of these facts and of the invasion of Zululand, it again becomes the duty of the friend of wild and simple peoples to protest against the policy of the conscienceless destruction of weak and friendless nationalities for the mere selfish purpose of the acquisition of territory and the practical, if not the nominal, enslavement of the poor defenseless natives. We cannot but arraign the lust for gain of the whole British people as the popular basis of the policy now called "Imperialism," and wish that British statesmen could rise above the vulgar avarice of the masses and teach the people a sense of the common duties of humanity and the obligations of common brotherhood, and that nations are under moral obligations to each other as well as individuals. It is the old spirit of "trade" and "commerce" regardless of the infringement of popular rights or the infliction of

individual suffering, and as "might makes right" the poor savage must succumb to the power of the "nation of shopkeepers," which needs more markets and more producers. This nation is in immediate need of more land and more slaves to cultivate it, in order to the support of her increasing classes of non-producers, her ornamental aristocrats and hangers on. More territory must, in consequence, be annexed, more wild people must be enslaved to cultivate the land, to the end of paying more taxes, making more revenues and creating more markets for British manufactures.

The protection which England professes to bestow upon wild and weak people is a poor return for national enslavement, the grinding taxation which crushes out the spirit and happiness of a people is not compensated for by the protection supposed to be afforded to life and property. The defense of her actions and her avarice is the transparent apology of carrying the blessings of civilization to savage people, and that she makes them happier by preventing bloodshed and cruelty, by conferring Christianity and educating them in the ways of western nations. But while she is justified in restraining evil passions and preventing tribal wars with their attendant miseries, she is not justified in committing the same or equivalent crimes for the purpose of complete political conquest and subjugation. All the world knows that it is the same old motive, the same that actuated Cortes and his band of heroic murderers in the conquest of Mexico. They fought, deceived and subjugated the valiant Mexicans in the name and by the authority of the cross; they filled their chests with the poor Indian's gold, took his lands, slew him and enslaved his children, and compensated the survivors for their outrages by forcing upon them a religion. The Spaniards there and elsewhere acted upon the ultra-principle, that the need of a people to the blessings of the gospel, stood in exact ratio to the amount of gold or fertile lands they possessed, and that the religion the conquerors brought with them and inflected upon the conquered was a fair equivalent for wholesale robbery, murder and enslavement. The spirit which actuates British conquest is precisely the same, for while England has been, perhaps, on the whole, more humane than Spain, she has pretended that her dominion over savage people was merely for their own good, when the real motives, as all the world knows, are avarice and aggrandizement of British territory, wealth and power.

It is now three hundred years since the conquest of the rich native races of America, *because* of their wealth in gold or land, but in all that time the great Christian nations of the world have grown but little better in their treatment of weak neighbors. They have yet to acquire and understand that moral sense of right which recognizes that the claims of weak nations to independence, be they savage or civilized, are as just and weighty and entitled to as much consideration by strong powers as the claims of the latter to the same prerogative; and that autonomy is not an exclusive and peculiar privilege, depending upon the might of the nation which assumes it to maintain and defend it, but that it is a fundamental and primative right, hereditary in a race, and possessed by reason of racial and

well marked ethnical distinctions. The nineteenth century is vain of its civilization, so called, and of the moral height attained in the enforcement of justice and fair dealing between man and man; but we yet behold in all its primitive, savage simplicity, the *un*civilized spectacle of nations acting toward each other according to the principles which govern the intercourse of the lowest savage men, as in the infancy of the race, or of wild animals; *i. e.*, the undisputed *right* of *might*, and the privilege of one nation to conquer, crush and enslave another—*if* it can do it. But we are unjust to the animal world, for some of them are charitable towards their weaker neighbors and do not destroy them merely because they can. No such natural moral code obtains between nations, however, for they would conquer and destroy each other like madmen, if they could. We are the contemporary witnesses in this pharisaical nineteenth century of great nations, like England and Russia, irritating and insulting their weaker neighbors, who, having the temerity to resent wanton injury and resist encroachment, are immediately crushed and absorbed. The "honor" of the bigger animal must be vindicated and avenged by the destruction of the smaller. We might find another illustration and analogy in the dealings of children with each other, who, as is well known, represent in the various phases of their mental and moral development, the many stages through which our species has passed in the process of evolution from lower to higher types. The big boy covets the toy of the small boy; he picks a quarrel with him by an insult which the small boy cannot help but resent, whips him because he resents it and acquires the toy on a predetermined result of the controversy. How painfully like the actions of great nations toward the smaller. In the primitive age, the childhood of the species, we know that the same principle prevailed; might made right, and if one individual desired what another possessed, he took it if he could and murdered the owner. Reasoning from the analogy, we cannot but conclude that the code of international morals is yet in its incipiency, "without form and void," and that the progress of the development of the principles of justice and right between nations and races has not kept pace with their growth as between individuals. The fair and just treatment of individuals by each other has been brought about by the evolution of laws, enacted and enforced by a central power, called the government, for the common good of the mass of the people; sometimes, of course, to the detriment of individual success in acquiring fortune or power by restraining selfishness.

The universal tendency of the individuals of all nations to revert to the conditions of barbarism and the rule of brute force immediately on the absence of law, has been amply demonstrated, as in the case of remote colonies, or new settlements and similarly circumstanced conditions. The forcible control of individual action is imperative even in the most highly cultivated and civilized countries. This is a sad comment upon our boasted civilization and morality; but it is none the less true that we must yet be restrained by force and the fear of punishment from murdering and plundering each other. But yet these natural, animal propensities which are controlled in individual dealings, are given full sweep in

international affairs, apparently for the reason that there is no interfering, stronger power—at least none which they recognize as to which they render allegiance—which will hold them accountable and punish wrong doing. Might seems to make right and differences are adjusted by the simple demonstration as to which one of the contestants possesses the superior strength—just as in animal nature.

And it is painful to contemplate that the great, the powerful, the civilized, the aggressive nations of the earth to-day are *Christian* in religion—a creed which teaches love, charity, benevolence, forbearance and brotherly kindness toward our fellow men! We are taught by the example of *these* nations—strong and powerful by reason of their civilization and intelligence, the professors of Christianity—that *weak* nations—peoples weak by reason of their ignorance and mental and moral depravity and superstitious—have no rights, because they are weak, which the stronger nations are bound to respect! Their actions are in direct conflict with the principles of the religion which they so loudly profess, and the candid man must brand them as national hypocrites and knaves. Amongst others, England has many sins to atone for in this respect, but one of the most flagrant wrongs, one of the most shameful employments of power, was in the forcing of China to admit the opium of India, to the detriment and moral ruin of her people, in order that India might have a market for the soul and body destroying commodity, and Englishmen amass wealth from this ill-gotten gain! This great national crime should be clamored in the ears of England until she redresses the wrong or repudiates her Christianity and becomes consistent at least. Nations are more shameless in their inconsistency with their professions of religion than individuals, which is saying much for national immorality.

The poor Zulu nation is the last, up to date, of the long line (not yet terminated) of the victims of British arrogance and avarice. The Zulus naturally and and patriotically resented the claims and arrogant demands of England, which they and all the world knew meant merely conquest and absorption, peaceably if possible, forcibly if necessary. At last their gallant chief, goaded into resistance, repelled invasion and was successful in the first conflict. Of their victory all friends of wild people and of the principle of racial autonomy were heartily glad, regretting only the cruelty with which it was attended. We could only wish that the chief had had the wisdom to push his success before reinforcements could have reached the British, and the policy to skirmish and raid without cruelty, and thus crowd the British commandant into an acknowledgment of Zulu independence and the definition of a compromise boundary line. But his savage ignorance was his ruin and he and his unfortunate people must suffer defeat, destruction of nationality, absorption and slavery. "British honor has been insulted" by the heroic defense of primitive rights by a simple people, and they must be crushed that British "honor" (?) be avenged. The big animal irritated the little animal into resenting wanton insult and the big animal's honor must be vindicated by whipping and eating the smaller. The weak nation has risen in its patriotism to fight in defense of homes and national life and its resistance, is, forsooth, a crime,

because directed against *British* arms! Patriotism has been counted a cardinal virtue from classic ages, and the Briton of to-day thinks his life a small sacrifice when offered in defense of British honor. Is patriotism any less a virtue in a savage, and why? If he defends his country against British assault, why is his patriotism criminal? It is simply the spirit of Cortes and the conquerors, who dubbed the patriotic resistance of the Mexicans "rebellion" and punished it with death or slavery. In the Spaniard of the sixteenth or the Englishman of the nineteenth century it is simply the childish national *Ego*, which arrogates everything and every virtue to itself and denies, unreservedly, everything, every right or claim to others—especially the weak.

England is, of course, bound now to continue the war with and defeat the Zulus, because of the national disgrace of the defeat of arms, when she can undoubtedly do so, but the avenging of that insult does not warrant the conquest and absorption of the entire Zulu domain. In all common justice and honesty, the conquerors have no right to annex another country to their own merely because they can. Such a transaction between individuals is called robbery, crime, felony; and with nations it would seem that, as O'Connell has well said, "nothing can be politically right which is morally wrong." Yet nations have committed this crime since time began, unless prevented by the united protest or armed interference of other countries, as in the case of European states, where mutual interest, and, in some cases, friendship, has prevented extensive conquest by any one country, as all are interested in the distribution of power. But the poor Zulus are a wild and savage people with no friends to interfere in their behalf and no rights a *civilized* country is bound to respect. The octopus arms of the destroyer are already fastened upon them and there is no escape from the deadly grasp but in national death. The material existence of the nation will soon be crushed out, and they, like the millions gone before, will labor, suffer and die that Britain may be rich. And the octopus arms, insatiable, will reach still on and on, grasping, strangling, enslaving, killing!

But let us hasten to create another picture, more pleasing than the first; let us present a contrast to the existing state of international morals. Let us suppose that the civilized and powerful nations of the world would break away from their shameful precedents and adopt and inaugurate a new system in their dealings with each other and with weak and savage peoples; a system of justice and right, such as they enforce between individuals; which should demand that the strong and rich powers should protect and care for the poor and weak nationalities and races; that the ignorant and indolent among nations should be educated and elevated in mind and morals, and be taught honest self-support and self-government; that the vicious and cruel should be restrained and controlled and by education be lifted above the practice of vices natural to man; and, in brief, that all nations should put into practice in international dealings that theory of brotherly love and the recognition of natural rights between nation and nation, as well as between man and man, which is the sum and substance of that Christianity which so many

of them boast of and so few of them practice. Under such a rule the world would, indeed, be a paradise, and the attainment of such a condition of things is not impossible, nor the idea so Utopian or impracticable as at first appears. Let us detail:

The central principle of our system is this: That it is not too much to assume that the racial, ethnical line of distinction between peoples should be the national line; that where the races divide the nations should divide; that a nation should be comprised of one race or sub-race, and one only; that the right of races to autonomy, independence, self-government is as sacred and natural as that of an individual to life and freedom, and that the prerogative is inalienable by reason of inherited privilege and ethnical distinctness. Races and sub-races are sufficiently marked and individualized as to render them readily distinguishable, and this line of radical distinction should be the national line. Every race is distinguished in a marked manner from every other race, by physical and mental peculiarities, customs, government, etc., and such peculiarities we assume to be indicative of the right to independence. Even the weak races, by reason of their distinctness alone, should be considered as being just as much entitled to the sacred prerogative of independence and self-government as the strong races, and in the name of suffering and oppressed humanity, and of Christianity, it is high time that the latter unite and form compacts and agreements to bear and forbear, to restrain themselves and others, and prevent useless destruction by strong and unscrupulous powers, who kill merely because they can.

(*To be continued.*)

MEDICINE AND HYGIENE.

HOT WEATHER HINTS.

J. R. BUCHANAN, M. D.

The fatality of the hot season, especially to children, is well-known, and this, with the immense sums expended by city people in seeking summer retreats, gives high importance to the question how we can best manage the hot weather.

The proper management should be both preventive and curative. As a curative measure I advise my friends to take from five to ten drops of dilute phosphoric acid (which can be cheaply obtained at any druggist's) in a glass of sweetened water. This can be repeated as often as necessary, but I would not recommend any one to use more than sixty drops, or a teaspoonful, in twenty-four hours. This is a cooling tonic and restorative to the system. Under its use the hot weather soon ceases to be intolerable, and its exhausting effects disappear. This

is real "brain food," but it would restore many a drooping invalid to health by a pleasant phosphoric lemonade.

For the children who are passing away by the summer complaint there has never been devised anything better than the old "neutralizing cordial," which has been in use for fifty years, but which is not as well known in New York as in other cities. It is a preparation of equal parts of peppermint plant, rhubarb, and saleratus (bicarbonate of potassa, not soda), made into a cordial with loaf sugar and brandy (or alcohol), and sometimes improved by an addition of cinnamon. It is the most harmless and perfect agent for the treatment of diarrhea, ever invented, and may be given to the youngest infant with impunity. Twenty drops for an infant, and two to four teaspoonfuls for the adult, may be repeated at intervals of four or five hours until relief is obtained.

But the important management to which I beg the attention of the *Sun's* readers is the preventive. In the first place, if the ailantus nuisance were exterminated and our shadeless streets lined with elms and maples, our windows protected by awnings, and our houses by creeping vines and verandas, and our roofs by non-conducting lining, we should not have much to complain of. Still we are not without resources.

Every house should be open to the night air, and closed against the heat of day. The upper sash of every window should be lowered all night, and every trap-door or inner door of the house should be open for ventilation. The higher the windows the more necessary it is that they should be opened, as the hot air accumulates in the upper part of the house. All garret windows and doors should be kept open habitually, and on hot nights a few buckets of water should be expended from a watering-pot in watering the roof and the garret. The hanging of wet sheets and clothes in the garret contributes to the cooling of the house.

To those who have a few dimes to spare it is perfectly easy to secure as cool a residence in the heart of a city as can be found on the sea-shore or the mountains, and it would certainly be folly for delicate invalids to run away from the comforts and kindness of home to escape the heat, when the home can be made as cool as the mountain top.

By repeating the precautions already mentioned, our houses ought not to rise above 80° in their interior temperature. My own office has not been above 80° this season. By the proper use of ice the interior of our houses can be kept throughout the summer as cool as any one could desire. From 65° to 70° is a delightful summer temperature. Few would desire it as low as 60°. To maintain this temperature requires only the use of a sufficient amount of ice to absorb the excess of caloric above 65°. If the air in the house has risen to 85° (and it ought not to be allowed to rise above 80°) the abstraction of 20° would be required. This for a room fifteen feet square and ten feet high would require (as the specific capacity of air is to that of water nearly as 1 to 4), between six and seven pounds of ice. If the entire area of a house is equal to ten such apartments, about sixty-five pounds of ice would reduce its air in summer to 65°. But if the

house has been cooled by night ventilation to 70°, then from sixteen to twenty pounds of ice would complete the cooling.

The way to effect the cooling would be to place the ice in metallic vessels in the highest part of the house, over its halls and stairways, while the doors and windows are closed to keep out the warm air.

As the house I have supposed would contain from 1,800 to 2,000 pounds of air (unless very largely filled with furniture), the quantity of ice required to cool this amount is not the limit, for in the middle of summer the walls have also become heated, and the supply of ice will have to be doubled until the walls and furniture have become cool, and an additional supply will be required if there are many gas-lights, or if the heat of the kitchen is allowed to ascend into the halls and apartments. But at the beginning of warm weather, or after the house has been well cooled, the calculations I have made will be applicable. Probably 60 to 100 pounds of ice daily, if properly managed, would make the average brown stone house of New York comfortably cool.

For the invalid it will be indispensable to cool the whole house. A tin bucket filled with ice, and supported or suspended near the ceiling, or above a wardrobe would be a very economical way of getting the coolness of mountain air. Of course, if the doors and windows are opened it will require more ice.

This coolness will be especially refreshing in sultry weather, when the heat is most oppressive, bringing delicate persons almost to the verge of sunstroke; for the ice condenses the moisture and dries the air of the apartment. Hence in sultry weather more ice will be required than in dry weather, but its beneficial effects will be more marked.

In commending this hygienic plan to the medical profession I would add that it will greatly reduce the mortality of fevers and of all diseases that are aggravated by hot weather. It is their duty to demand that invalid apartments shall be kept down by ice below 65° of temperature.

If hospitals, quarantine stations, and pest houses were cooled by ice, as I suggest, the expense would probably be saved in the diminished consumption of drugs and the smaller number of funerals. But, without regard to pecuniary considerations, the check given to infection, the diminished mortality, and the vast reduction of suffering are imperative reasons for cooling by ice.—*N. Y. Sun.*

NEGLECT OF THE EYE.

BY DR. EDWARD G. LORING.

Whatever an ounce of prevention may be to other members of the body, it certainly is worth many pounds of cure to the eye. Like a chronometer watch this delicate organ will stand any amount of use, not to say abuse, but when once thrown off its balance, it very rarely can be brought back to its original perfection of action, or, if it is, it becomes ever after liable to a return of disability of function or the seat of actual disease. One would have supposed from this fact, and

from the fact that modern civilization has imposed upon the eye an ever-increasing amount of strain, both as to the actual quantity of work done and the constantly increasing brilliancy and duration of the illumination under which it is performed, that the greatest pains would have been exercised in maintaining the organ in a condition of health, and the greatest care and solicitude used in its treatment when diseased. And yet it is safe to say that there is no organ in the body the welfare of which is so persistently neglected as the eye.

I have known fond and doting mothers take their children of four and five years of age to have their first teeth filled, instead of having them extracted, so that the jaw might not suffer in its due development and become in later years contracted, while the eye, the most intellectual, the most apprehensive, and the most discriminating of all our organs, receives not even a passing thought, much less an examination. It never seems to occur to the parents that the principal agent in a child's education is the eye; that through it it gains not only its sense of the methods and ways of existence of others, but even the means for the maintenance of its own; nor does it occur to the parents for an instant that many of the mental as well as bodily attributes of a growing child are fashioned, even if they are not created, by the condition of the eye alone.

A child is put to school without the slightest inquiry on the part of the parent, and much less on the part of the teacher, whether it has the normal amount of sight; whether it sees objects sharply and well defined, or indistinctly and distorted; whether it be near-sighted or far-sighted; whether it sees with one or two eyes; or, finally, if it does see clearly and distinctly, whether it is not using a quantity of nervous force sufficient after a time not only to exhaust the energy of the visual organ, but of the nervous system at large.—*Harper's Magazine for August.*

YELLOW FEVER PRECAUTIONS.

The Executive Committee of the National Board of Health invites the attention of all state and municipal authorities and sanitary organizations to the fact that they should without delay endeavor to secure the best sanitary condition of places and people under their charge, and whatever opinions may be held as to causes of yellow fever and of the recent appearance of that disease in Tennessee and Mississippi, to act as if it were a disease due to a specific particular cause which is capable of growth and reproduction, transportable, and may be destroyed by exposure to a temperature above 250 degrees Fahrenheit, or by chemical disinfectants of sufficient strength, if brought into immediate contact. It is also prudent to assume that the growth and reproduction of this cause are connected with the presence of filth in the sanitary sense of that word, including decaying organic matter and defective ventilation as well as of high temperature. The cases of yellow fever recently observed should be considered as due to causes surviving from last year's epidemic and to recent importation from other countries. It fol-

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lows that there is a liability to the appearance of other cases in places visited by the epidemic of last year, and that there is danger of a spread of disease to the north and east.

The object of the present circular is to advise that all cities, towns and villages be at once made clean in a sanitary point of view. The first step toward securing cleanliness is to obtain reliable information as to what parts of places are clean and what foul. The result of careful sanitary inspection in almost any city or town will show the existence of collections of decaying and offensive matter previously unknown, and which every one will admit should be promptly removed and destroyed. Such inspection, to be of value, must be thorough and made by persons competent to recognize foul soils, water and air, as well as the grosser and more palpable forms of nuisance. They should also be made by persons who would report fully and frankly the results of their observations, without reference to the wishes of persons or corporations. When the whereabouts and extent of the evil is known, the remedy is usually almost self-evident. The National Board of Health will furnish, on request, blank forms as a guide for such inspections.

[July 23. The National Board of Health report that their recommendations to the state authorities do not meet with a very general response and that thus far but three states have availed themselves of the facilities and means afforded.—ED.]

REMEDIES FOR SUNSTROKE.

New York city is threatened with a sunstroke season, and Dr. Jones, of the Board of Health, has issued the following circular, applicable in this city as well:

"Sunstroke is caused by excessive heat, and especially if the weather is 'muggy.' It is more apt to occur on the second, third or fourth day of a heated term than on the first. Loss of sleep, worry, excitement, close sleeping rooms, debility, abuse of stimulants, predispose to it. It is more apt to attack those working in the sun, and especially between the hours of 11 o'clock in the morning and 4 o'clock in the afternoon. On hot days wear thin clothing. Have as cool sleeping rooms as possible. Avoid loss of sleep and all unnecessary fatigue. If working indoors, and where there is artificial heat—laundries, etc.,—see that the room is well ventilated. If working in the sun, wear a light hat (not black, as it absorbs heat), straw, etc., and put inside of it on the head a wet cloth or a large green leaf; frequently lift the hat from the head and see that the cloth is wet. Do not check perspiration, but drink what water you need to keep it up, as perspiration prevents the body from being overheated. Have, whenever possible, an additional shade, as a thin umbrella when walking, a canvas or board cover when working in the sun. When much fatigued do not go to work, but be excused from work, especially after 11 o'clock in the morning on very hot days, if the work is in the sun. If a feeling of fatigue, dizziness, headache or exhaustion occurs, cease work immediately, lie down in a shady and cool place; apply cold cloths to and pour cold water over head and neck. If any one is overcome by

the heat send immediately for the nearest good physician. While waiting for the physician, give the person cool drinks of water, or cold black tea, or cold coffee, if able to swallow. If the skin is hot and dry sponge with or pour cold water over the body and limbs, and apply to the head pounded ice, wrapped in a towel or other cloth. If there is no ice at hand keep a cold cloth on the head, and pour cold water on it, as well as on the body. If the person is pale, very faint and pulse feeble, let him inhale ammonia for a few seconds, or give him a teaspoonful of aromatic spirits of ammonia in two tablespoonfuls of water with a little sugar."

HYDROPHOBIA.

Dr. Francis Quixano, of New York, in a communication to the *Times* makes the following propositions in regard to this terrible disease:

First, that hydrophobia cannot be communicated by a non-rabid dog. Second, that rabies can be originated *de novo* in a female dog as well as in the male. Third, that after the dread of water is once manifested in the human subject the patient cannot swallow liquids or solids, and, therefore, that a good many cases reported as of hydrophobia have been really cases of *traumaticus tetanus*, or of mental hydrophobia. Fourth, that confirmed rabies has a symptom which is not mentioned in most of the medical treatises, and this symptom is not found in *traumaticus tetanus* and mental hydrophobia. Fifth, that genuine hydrophobia kills, invariably, within the fourth day after the first symptoms of invasion. Sixth, that in rabies the human subject is always perfectly rational up to the last moments, never bites nor tries to bite, and doesn't bark. Seventh, that dysphagia, or the impossibility of swallowing, never shows itself as the first symptom of the stage of invasion. Eighth, that curara (not woorara), vapor baths, strychnia and hypodermic injections of morphia and atropia are powerless, even at the first symptoms of the stage of invasion, and that vapor baths, cauterization with lunar caustic, and washing the wound with phenic acid (improperly called carbolic acid), do not prevent the development of rabies. Ninth, that hydrophobia can be arrested if other means are used in time, and even that the patient can be saved if the right remedies are applied at the stage of invasion.

BOOK NOTICES.

EIGHTH, NINTH AND TENTH ANNUAL REPORTS OF THE GEOLOGICAL SURVEY OF INDIANA. By E. T. Cox, State Geologist, assisted by Prof. John Collett and Dr. G. M. Levette. Indianapolis, 1879; pp. 541, octavo.

We are indebted to Prof. John Collett, now Chief of the Bureau of Statistics and Geology of the State of Indiana, for the above named volume. The surveys were made during the years 1876, '77 and '78, and this volume is devoted princi-

pally to detailed reports of the counties of Wayne, Crawford and Harrison, with a general review of the Geology of the State, etc.

The chapters upon the Glacial Drift and Archæology are especially interesting, for Indiana, perhaps more than almost any other State, shows the wonderful results of glacial action, in the immense beds of agglomerated rock, metal, clay and coal, including specimens of all the formations lying to the northward, without regard to their geological age or position, which stretch clear across from Ohio to Illinois, often 50 and sometimes as much as 90 feet in thickness; while in Antiquities she is particularly rich, as the researches of Messrs. Morrison, Sutton, Gerard, Blunt, Sampson and others have demonstrated.

The survey of Indiana is well advanced and is being thoroughly done by the accomplished and energetic men in whose hands it has been placed.

First Biennial Report of the State Board of Agriculture of Kansas. Vol. VI, second edition, 1877–78; pp. 632, octavo. Rand, McNally & Co., Chicago.

We have several times had occasion to refer in complimentary terms to the good judgment and wisdom of the State Board of Agriculture of Kansas in publishing its reports and scattering them broadcast over the country, instead of wasting its funds in making displays at State fairs and cattle shows.

The volume before us is but another evidence of this same policy. It is a beautiful book in every way, printing, binding, illustrations and all, and one which will be examined with interest and preserved with care by all who can obtain possession of it.

The information contained in it has been compiled with great pains and is presented in tabular and statistical form, county by county, and township by township. A colored map of every organized county in the State is given, with a careful description of its topography, quality of soil, mineral productions, number of inhabitants, school facilities, etc.

No State in the Union, so far as we know, issues so elaborate and so useful a work, and Kansas is to be congratulated on having so competent and zealous a man as Alfred Gray as Secretary of her State Board of Agriculture.

The Principles of Light and Color. By Edwin D. Babbitt, D. M., New York. Babbitt & Co., 1878; pp. 576, octavo. $4.00.

Aside from the indisputable fact that this is one of the handsomest and most elaborately illustrated specimens of book-making that has come to our table, there is a charm about Dr. Babbitt's earnest and forcible manner of treating the various branches of his subject which takes the reader with him, whether he may exactly indorse the writer's theories and reasoning or not.

The scope of the work is large, embracing: The Harmonic Laws of the Universe; Insufficiency of the Present Theories of Light and Force; The Etherio

Atomic Philosophy of Force; The Sources of Light, (Natural and Artificial); Chromo Chemistry, (the mystery of Chemical Affinity solved); Chromo Therapeutics, (marvelous cures by Light and Color); Chromo Culture of Vegetable Life, (immense growths); Chromo Philosophy, (made doubly clear by the Atomic Theory); Chromo Dynamics, or Higher Grade Lights and Forces; Chromo Mentalism, (Wonders of Color in connection with Mental Action); Vision, (Mysteries and diseases of the Eye).

The chapters on the Sources of Light and Chromo Chemistry will be found particularly interesting and valuable to all classes of readers, since they are devoted principally to descriptions and discussions of unquestioned facts in these branches of science; while the chapters on Chromo Therapeutics and Chromo Mentalism will furnish food for thought and argument to such readers as are interested in the healing power of color and in spiritualism. The theories are in many instances novel, but at the same time are claimed to be based upon and supported by actual experiment. There is no doubt that it is a most fascinating work, which will be read with the greatest satisfaction by many who have hitherto had no scientific authority to appeal to for help in their philosophic speculations. The illustrations, one of the prominent features of the work, number over two hundred and are of the finest quality.

PUBLICATIONS RECEIVED.

Report upon Magnetic Observations in Missouri in 1878, by Prof. F. E. Nipher, St. Louis. The St. Louis Journal of Commerce; the University Missourian, Columbia, Mo.; Picturesque Minnesota, a guide for tourists to the Northwest; Atti della Societa Toscana di Scienze Naturali; a Treatise on the Horse and his Diseases, B. J. Kendall, M. D., Enosburgh Falls, Vt.; The Wandering Cainidæ, or the Ancient Nomads, by Mathew Kempf, M. D., of Ferdinand, Indiana; Chicago Inter-Ocean; The Enterprise-Messenger, with an able article by Hon. B. B. Cahoon on Routes to the Sea Board; Illustrated Scientific News, New York; The Microscope in relation to Medicine and Cerebral Pathology, by I. N. DeHart, M D., Mendota, Wis.

SCIENTIFIC MISCELLANY.

RECENT MASTODON FINDS.

On the 5th inst, Mr. Hugh Kelly, a farmer of New Windsor, New York, discovered in a swampy piece of ground near his house, the second joint of the fore leg of a Mastodon. On Sunday the excavating was continued and their labor was rewarded by finding nearly all the bones of a giant mastodon. A trench about thirty feet long, ten feet wide and four and one-half feet deep has

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been dug so far and the men are yet at work endeavoring to recover what is needed to make up the whole frame or skeleton. Operations were resumed early this morning on a larger scale and several sections of the spine, two more ribs and other pieces have been recovered to-day. A spring of cool water has been struck and the diggers are troubled bailing it out. The black vein of muck is said to be about twenty feet deep and rests on a bed of blue clay. As stated, it at one time formed the bed of a good-sized pond, and it is conjectured, as in the cases of other mastodons found, that the animal waded in beyond his depth, got fast and perished. When the upper jaw of the skull was found there was great difficulty in getting it to the surface whole. It took five men to lift it out of the trench. It was found four feet six inches below the surface. The lower jaw was four and a half feet below the surface, and some three feet distant from the upper jaw. It required two men to lift it out. The backbone and spine were not over two feet under ground. Other pieces have been found in various portions of the trench.

About the same time a Mr. Houbler, of Ottumwa, Iowa, discovered about six miles south of that place, a tusk three feet and two inches in length. The tusk, when found, was entire, and was partially covered with a deposit of scale formed by the infiltration of iron in solution acting on gravel. It was accidently broken, however, and the interior composition discloses clearly what the relic is. The tusk is four and one-half inches in diameter at the thickest part and about thirteen in circumference. The interior composition is a white substance (carbonate of lime) preserving the original structure and greatly resembling ivory. The relic is without much doubt the tusk of a mastodon, *elephas primigenius*.

On Friday afternoon, June 27th, a party went over to the celebrated "Salt-Lick," on Salt Creek, in Davis County, Iowa, where the fossil bones of a gigantic creature, supposed to be the *Plesiosaurus*, were found. This is an interesting region, abounding in petrifactions, animal and vegetable, that we propose to fully explore at some future time.—*Democrat & Times*.

THE PANAMA SHIP RAILWAY.

Captain J. D. Eads, who has so successfully completed the Mississippi River jetties, gives to the *Globe-Democrat* the following information relative to his plan of transporting ships across the Isthmus:

"Since the estimates published by the Paris Convention for the cost of the Isthmus Canal were learned by me, I have been almost incessantly studying the problem, because I felt assured that the conveyance of ships by railway across the Isthmus with perfect safety and dispatch was entirely feasible, and my recent studies have satisfied me that it can be accomplished for at least one fourth of what it will cost to cut a canal, and that the railway can be completed in one-fourth the time necessary for the canal I do not believe it possible to employ

enough men and enough machinery to execute the canal inside of twenty years, especially if it be determined to cut the canal down below the sea level. If locks be provided at each end of a canal sufficient to raise the bottom of the prism of the canal above the sea level, it will be seen at once that all danger of interruption by water rising through the interstices of the soil and rocks from the ocean itself will be avoided; but if the prism be cut down below the sea level, the sea will furnish an unfailing source of supply of water to delay the construction. This will not be a matter of serious trouble so long as the soil admits of the use of dredgers; but we have reason to apprehend that the Cordilleras will present a very different material from that which dredging machines working in water can operate upon, and if the excavation must be made below the sea level, no engineer can foretell the cost or delay to which the work will be subjected by interruptions from water. The rainy season continues from May to November, and during half of the year no work can be done in that climate."

"The methods which I suggested in my letter to the New York *Tribune* were simply those which first came into my mind, and which, although practical, admit of great improvement. Further study has led me to believe that the most economic method would be to bring the ships out of the water up an inclined plane, the ship being placed parallel with the bank up which they would be drawn—that is to say, they would be drawn up sideways, and the cradles moving on this inclined plane would have railway tracks on them, also parallel with the shore. On these tracks the cradle, or car, in which the ship is to be placed, would be run from the end of the permanent railway. When the cradles of the inclined plane were up, the tracks on them would correspond with the rails of the permanent railway, so that the ship cradle could be run on or off from them. When the ship is drawn up out of the water she would start on her journey on the railway at right angles to the direction of the inclined plane. The details or devices by which the ship can be taken out of the water admit of great variation, and it will only be by long study and careful comparison that the best and cheapest can be determined upon. Messrs. Flad and Chanute both differ from me in some of these details, and with each other, but both are engineers of unquestioned ability and great ingenuity, and I have no doubt that a few days or weeks spent with them over the problem would result in our coming to one conclusion upon every point of importance involved in it."

"The plan proposed is not new, but has been repeatedly suggested before; but I believe that no one has given it sufficient attention to work out the details, and, indeed, many of these can only be determined after careful surveys are made and the conditions presented by the location selected are fully understood. The ship-railway plan has had the endorsement of one of the ablest engineers in England. The transit of ships across the American Isthmus is one the greatest needs of the American people, and I told Gen. Grant when the jetty bill was pending in Congress that as soon as I opened the mouth of the Mississippi I intended to devote my energies to the solution of the problem. I do not wish to

interfere with or oppose M. Lesseps in the construction of his canal, but I do intend, if my life is spared, to give the necessary relief to our commerce at a much earlier date than is possible by a canal. In fact, I feel sure that the railway can be built and that its cost can be re-imbursed to its owners from its profits before a canal can be made available. I intend to ask Congress for authority to form a company to build it, and to send out an expedition to make additional surveys of the isthmus with a view to discover the best location for a railway. All the official surveys thus far made have been to select a route for a canal. The conditions for a canal are so much more difficult and exacting than for a ship-railway that I believe ten practicable locations for the latter may be found on the isthmus for every one that can be found for a canal."

SAN JUAN COAL FIELDS.

We clip the following from the New York *Mining Record*, showing that prominent journals appreciate the efforts of the TIMES to place before the public the resources of the San Juan. We know that this article has attracted the attention of several gentlemen of means who intend to give the subject a personal investigation.

"Professor Hayden, in his geological and geographical reports of his surveys of the State of Colorado, gives full testimony to the vastness of the coal resources of the San Juan region in Gunnison, Ouray and La Plata counties, in close proximity to rich veins of the precious metals, and in the line of railroads to be ultimately built. Recently and very properly, the Ouray TIMES has been calling special attention to this important demand in the future mineral development of its section of the State, in an article from which we condense the fact that from within a few miles of Mount Lincoln on the north, on the western slope, and extending around to the east bank of the Rio San Juan south, of the snowy range, the coal measures appear wherever the mountains "break off."

This coal as a general thing is a most excellent bituminous coal, as neat as anthracite; it leaves no stain on the fingers; produces no offensive gas or odor; leaves but little ash, no clinkers, and produces no more erosive effect on stoves, grates or steam boilers than dry wood. This description will apply very nearly to all the specimens taken so far from various places in this great basin. A few miles south of Animas City, in La Plata county, are veins twenty-two feet thick and coal from these mines has been successfully manufactured into coke. No less than six strong companies have taken measures to secure coal lands from which to procure coal for coking.

The coal is in the paleozoic, lower tertiary and lower Silurian sandstone and calciferous sand rock with arenaceous clay, and in some places dark cretaceous clay with red hematite and spathic iron ores.

The enormous and unprecedented thickness of some of these coal veins, and the ease with which they can be worked, are astonishing.

Our Colorado contemporary concludes: "Here, then, is the fuel supply which will cause the San Juan mining region, in that respect, to rank second to none in the world. The coal can be conveyed at slight expense to any point by projected lines of railway, or the ore can be shipped down from the mines to reduction works in the valleys."—*Ouray Times.*

JAPANESE ÆSTHETICS.

BY REV. W. E. GRIFFIS.

In every house of the better sort in Japan there is a *tokonoma*, or raised special place for keeping objects of art and beauty. The evolution of the æsthetic out of the useful is nowhere better illustrated than in the history of the tokonoma, which was anciently the sleeping-place, or recess for the bed. Now it is a place of honor, occupying one-half of a side of the parlor or best room, its finish and appointments being superior to those of any other part of the house. It is a recess two feet deep, and raised four or six inches above the matting-covered floor. In it hang suspended on the wall a *kakemono*, or scroll painting on silk, a bronze or porcelain vase of flowers, a fan-holder with its tiers of open fans ready for use, besides other works characteristic of native art.

One of the objects often seen is a *dai*, or stand, gold-lacquered, or made of perfumed, carved, or rare wood. The dai is one or two feet high, and has on the top a black velvet or crimson crape cushion, or a silver claw, whereon reposes a globe of rock-crystal. Pure, flawless, transparent, a perfect sphere, it seems like a bubble of spring water hovering in the air. Often the dai, or stand, is a piece of elaborate art in bronze, porcelain, or lacquer, representing a beetling crag or lofty inaccessible rock, crested with the flawless jewel. Around the base the waves curl and foam, and up the side moves in crackling coil a jealous dragon. with eager, outstretched jaws, and claws ready to grasp and bear away the precious prize. Or, on a pyramid of waves hardened in bronze, with silver foam-flecks on the polish of the rolling mass, will repose inviolate the gem sphere.

The Japanese virtuoso loves to have among his collection at least one bronze of wave and stormy petrel, where, amid the recesses of the hooked foam, nestle a half dozen or more of small crystal balls, from the size of a marble to that of an apple. In nearly all Japanese art and bric-a-brac stores will be seen these gems on sale, and unless the foreign buyer's nerves are very strong, the prices asked will be very likely to startle him as though he had been touched by an electric eel.

The merest tyro in Japanese art, be he admirer or purchaser, can not have failed to notice the dragon clutching in his claw a ball or a pear-shaped jewel. In the various forms of their art expression, crystal, both in China and Japan, commands a high value, both pecuniary and symbolic. In the airy realms of imagination, and in the markets where men buy and sell, rock-crystal is among the precious things.—*Harper's Magazine for August.*

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SICILY AND MOUNT ÆTNA.

It is gratifying to learn that with the restoration of peace and partial prosperity to Sicily, that noble Mediterreanean Island, more glorious in her ancient history and civilization than Rome herself, though in modern times robbed by misrule of all but the merest fragments of her once high estate, has emerged from her obscurity and begins to assume a fair portion of her pristine importance in the world. Agriculture has revived, commerce increased enormously, and science advancing equally, is about to build a new temple for herself in the very interior of the island. When the English occupied the island in 1811, during the Napoleonic wars, they built a small observatory near the base of the cone of the great crater of Mount Ætna, and the small house attached to it is still known as Casa Inglese. In the long years of trouble which followed the departure of the British troops this observatory was utterly neglected, and has partly fallen into ruins. It was too substantial, however, to be utterly destroyed, and it is now to be rebuilt upon a grander scale, and to be permanently occupied by distinguished astronomers. There are but few spots in all Europe better adapted for the work to be done. The site of the building is lofty, and the atmosphere is of unrivaled purity. It is one, too, where the marvelous beauty and grandeur of the scenery and the romance of its old historic associations will stimulate the imaginative faculties, without which no scientific explorer can hope for the most perfect and brilliant success. Mount Ætna is not nearly so generally known as Vesuvius, but this is because the latter is upon the mainland, near a great city which every one visits, and modern poetry and fiction have conspired to throw a rich halo over the famous eruption which buried Pompeii and Herculaneum under a stream of lava. For many years, too, Vesuvius has been far more active than Ætna, although, from the age of Pythagoras till 1874 history has recorded nearly eighty eruptions of the Sicilian Mountain—*Il Monte*, as the inhabitants proudly call it—and Ætna is in every respect the grander of the two. Vesuvius itself might be almost buried in the Val del Bove, a barren valley on the eastern side of the slope, surrounded on three sides by horrible precipices nearly 4,000 feet high. Ætna's legendary story is older—it goes as far back as the myths of Polyphemus and the Cyclops, it is immeasurably loftier, and Vesuvius is but a hill in comparison with the immense bulk and extent of *Il Monte*. Catania and Aci Reale, two great cities, and fifty or sixty smaller towns nestle upon its sides. And with the exception the of Val del Bove and the desert region at the base of the crater, three miles across the mouth, the whole slope of Ætna on all sides is rich and fertile, supporting a population of 300,000 souls.

Now that Sicily is nearly peaceful again, the erection of this grand new observatory will again attract the attention of the great scientific men of the age to Ætna, and through them the desire to see and explore Sicily will filter through the the great mass of travelers, ever eager for something out of the beaten track, and thus, ere long, perhaps, science may draw after her a long procession of pilgrims

from foreign lands, whose presence will be of incalculable value in promoting the full restoration of prosperity to the old granary of Imperial Rome.

The latest accounts of the eruption of Mount Ætna, now threatening with destruction several villages which have hitherto escaped the ravages of the lava, mention the formation of three distinct new craters at a great distance below the central cone, about 11,000 feet above the sea level. But these lateral escape valves, as it were, from the raging heat and fires within, are common to most volcanic regions, and from the earliest observations have been belived to be specially characteristic of Ætna. Sir Charles Lyell, who has made a close study of the great Sicilian Volcano, says that without reckoning numerous monticules of ashes thrown out at different points, there are about eighty of those secondary volcanoes or minor crators of considerable dimensions, fifty-two on the west and the north and twenty-seven on the east slope of the mountain. Monte Minardo, one of the largest, is more than 700 feet in height, and Monte Rossi, near the often-shattered village of Nicolsi, 450, with a base two miles in circumference. The new fissures which have just been pierced through the crust are, in fact, very far from a novelty in the history of *Il Monte*. They are simply another illustration of the frequent changes which have so frequently varied its surface. The great cone itself has more than once been varied, both in shape and height. After the great earthquakes of 1537 it fell in and 1693, after a temporary upheaval, it sank so much that it was invisible from many spots where it had previously been the principal feature of the landscape. The minor cones suffer similar variations in form. About 350 years ago a stream of lava so surrounded the cone called Monte Mucilli that the crest alone was left standing about the newly formed plain. Less than a century and a quarter ago another peak, Monte Nero, above the Grotta del Capre, was also almost covered by an eruption of lava and ashes from above.

The whole history of Ætna is marvelous, but one of the most extraordinary phenomena—not, perhaps, entirely dissimilar from that telegraphed on Friday—happened in 1669, nearly at the same time as the rise of Monte Rossi. In the plain of St. Lio a chasm six feet in breadth, and of depth never sounded by line or plummet, suddenly opened. Its course was winding in the ascent of the mountain, until it was suddenly closed within a mile of the summit. A brilliant light illuminated the skies from its nethermost recesses, and sounds like distant thunder were heard from time to time at a distance of forty miles. In 1832 similar, but far smaller, rents were forced open, and M. Elie de Beaumont, a distinguished French traveler and geologist, accounts for them upon the theory of an enlargement of the whole mass of the mountain by the Titanic forces of nature acting far beneath the upper surface of the earth, and finding their vent in volcanic energy. The opening of this great fissure or chasm in 1669 seems, indeed, to have marked one of the most terrible epochs of the whole history of Ætna. The ancient and beautiful City of Catania, cradled in the old days of Greece, was itself more than half destroyed. The lava overwhelmed fourteen villages, and at length reached the wall of the city built with the design of pro-

tecting its people from any possible danger from the crater. The rampart stood firm, but slowly and surely the burning stream reached its top, and then plunged over upon the devoted buildings beneath. The speed of the current was measured, and it was found that it traveled at the rate of 162 feet an hour for the first thirteen miles of its course, and in its later stages only twenty-two feet. The surface of the stream resembled a mass of solid rock, but below it was a fiery, sluggish liquid, and its resistless flow was only terminated when it reached the sea, and the molten river was then 600 yards broad and forty feet deep.

Nor are the observed and recorded wonders of Ætna confined to its surface. Volcanic action has produced subterranean grottos and underground passages which are among the marvels of nature. Lyell describes one of these great openings, the Fossa della Palomba, not far from Nicolosi. It is 625 feet in circumference at its mouth, and the upper vault is seventy-eight feet deep. Beneath this there is another huge and dark cavity, and still lower one after another in succession. Their sides are so precipitous that the descent is made by ladders, and finally at the end of a gallery, ninety feet long, there are enormous caverns, never explored and stretching, so far as science knows, into the very bowels of the earth. Of the origin of the mountain itself there are, of course, many theories. Sir Walter Raleigh, in his wonderful History of The World—yet more remarkable for its learning because it was chiefly composed in the confinement of a prison—gives a long list of authorities in support of the hypothesis that Sicily was once united to the mainland of Italy, as it has been an accepted fact England was once but a part of France. The separation, therefore, which must have taken place in prehistoric ages must have been due to the union of volcanic and oceanic action. And in Ætna even on the loftiest rocks there is much to corroborate the theory that the whole mountain was once covered by the ocean. Sea sand and marine fossil shells are found many hundred feet above the sea, and some of them are identical with species seen in the Mediterranean. In history, in tradition and in legend the Sicilian mountain thus appeals to us as no other volcano in the world can do. Of late years, in comparison with the study devoted to Vesuvius, science has been nearly mute in touching upon Ætna. For the last quarter of a century, perhaps since Gladstone's visit in 1838, she has almost disregarded Ætna. But the eyes of the whole civilized world are now fixed upon the grandest of all the volcanic mountains of the earth, and from observations now certain to be made, new lessons will be learned from the manifestation of the workings of the most tremendous forces of nature.—*Globe-Democrat.*

ART PICTURES IN STEEL.

At the meeting of the Iron and Steel Institute, says *Iron*, various art castings in steel were exhibited by Hadfield's Casting Company, Hecla Foundry, of Sheffield, where various art reproductions in steel excited great interest amongst metallurgists, it having previously been deemed impractiable to cast such articles in steel. These art reproductions illustrate some of the latest triumphs in the art of

steel casting. One of these antique pictures in steel is a *repousse* shield by Benvenuto Cellini, the famous artist in metal of the sixteenth century, and is supposed to represent the siege of Troy. Four other pictures represent the elements—earth, air, fire and water. The *basso relievos* are copies from the house of Henry the Fourth of Paris. Another represents the seasons,—spring, summer, autumn and winter. Another subject is children at play, and another is an eastern subject. These pictures are after the style of the French bronzes shown at the Paris Exhibition and were greatly admired by experienced and practical steel makers who know how difficult it is to obtain round castings in steel.

OLD TIMES.

Half a century ago a large part of the people of the United States lived in houses unpainted, unplastered and utterly devoid of adornment. A well-fed fire in the yawning chasm of a huge chimney gave partial warmth to a single room, and it was a common remark that the inmates were roasting one side while freezing the other. In contrast, a majority of the people of the older States now live in houses that are clap-boarded, painted, blinded and comfortably warmed. Then the household furniture consisted of a few plain chairs, a plain table, a bedstead made by the village carpenter. Carpets there were none. To-day few are the homes in city or country that do not contain a carpet of some sort, while the average laborer by a week's work may earn enough to enable him to repose at night upon a spring bed.

Fifty years ago the kitchen "dressers" were set forth with a shining row of pewter plates. The farmer ate with a buck-handled knife and an iron or pewter spoon, but the advancing civilization has sent the plates and spoons to the melting pot, while the knives and forks have given place to nickel or silver plated cutlery.

In those days the utensils for cooking were a dinner-pot, tea-kettle, skillet, Dutch oven and frying-pan; to-day there is no end of kitchen furniture.

The people of 1830 sat in the evening in the glowing light of a pitch-knot fire, or read in their weekly newspaper by the flickering light of a "tallow-dip;" now, in city and village, their apartments are bright with the flame of the gas-jet or the softer radiance of kerosene. Then, if the fire went out upon the hearth, it was rekindled by a coal from a neighboring hearth, or by flint, steel and tinder. Those who indulged in pipes and cigars could light them only by some hearthstone. To-day we light fire and pipes by the dormant fire-works in the match-safe at a cost of one-hundredth of a cent.

In those days we guessed the hour of noon, or ascertained it by the creeping of the sunlight up to the "noon-mark" drawn upon the floor. Only the well-to-do could afford a clock. To-day who does not carry a watch? And as for clocks, you may purchase them at wholesale, by the cart-load, at sixty-two cents a piece.

Fifty years ago how many dwellings were adorned with pictures? How

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many are there now that do not display a print, engraving, chromo, or lithograph? How many pianos or parlor organs were there then? Reed organs were not invented till 1840, and now they are in every village.

Some who may read this article will remember that in 1830 the Bible, the almanac, and the few text-books used in school were almost the only volumes of the household. The dictionary was a volume four inches square and an inch and a half in thickness. In some of the country villages a few public-spirited men had gathered libraries containing 300 to 500 volumes. In contrast, the public libraries of the present, containing more than 10,000 volumes, have an aggregate of 20,650,000 volumes, not including the Sunday-school and private libraries of the country. It is estimated that altogether the number of volumes accessible to the public is not less than 20,000,000! Of Webster's and Worcester's dictionaries, it may be said that enough have been published to supply one to every 100 inhabitants of the United States.—*C. C. Coffin, in May Atlantic.*

CLASSICAL ORIGIN OF BOSTON BAKED BEANS.

It is known to most of the inhabitants of the Ball that makes its diurnal revolutions around the Hub that we, who enjoy the felicity of dwelling in the center of all things, celebrate the rise of the Sunday sun by a repast of pulse and brawn, sometimes spoken of as "pork and beans," or "bacon and beans." Like most of the facts in the experience of the Bostonese, this habit has been pretty well advertised, and sometimes there have not wanted those of the vulgar herd who have been moved to animadvert with asperity upon the well-established custom We look upon all such flings with the lofty disdain that arises from a mind conscious of its own rectitude, and with pity for the ignorance from which they spring.

Generations ago, when many other parts of our noble land were howling wildernesses, our ancestors overhauled their classics, and made a note of the fact that the poet Ovid, of blessed memory, in his remarks appropriate to the calends of June, gives an account of the rite to which I have referred, which was promptly incorporated into the calendar of our beloved city.

We are classical, or nothing. We know that it is the good goddess Carna who protects the lungs and liver of man (or at least that she was wont to do so in classical times), and that in her honor the good people of classical days ate repasts of pulse and brawn. "You ask," says Ovid, "why fat bacon is tasted on these calends, and beans are mixed with the boiled spelt. She is a goddess of ancient days, and she still diets on the food that in olden time she used, and she does not, in a spirit of luxury, ask for the dainties of foreign lands. In that day the fishes swam uncaught by a people ignorant of the virtues of the succulent cod and of the luxury of fish-balls; and the oysters were still safe in their shells, no man having yet been found with sufficient courage to swallow even one of them.

Latium had not become acquainted with the woodcock which rich Ionia supplies, nor with the cranes that delight in the blood of the Pygmies. The toothsome peacock pleased but by its expanded tail, nor had foreign lands been drawn upon for their beasts of the chase But swine were valuable, and by killing a sow the fathers honored their festivals. The rock-bound land produced only beans and the hard-grained spelt, and whoever eats these two things mingled, they say that his stomach can receive no harm."—*Contributors' Club, May Atlantic.*

ABSENCE OF AGUE IN KANSAS ACCOUNTED FOR.

"But you have ague in Kansas, the same as in every other new country, don't you?" inquired Mr. Wabash.

"Only as it is brought in temporarily, from other States," Markley politely responded. "It is not indigenous. We have no malaria Our atmosphere is rich in ozone; and ozone is nature's own purifier. Homer mentions it in the Odyssey, you recollect, where he speaks of the atmosphere being 'quite full of sulphurous odor.' That's ozone.

"I presume the atmosphere of the infernal regions is also quite full of sulphurous odor,'—or ozone," said Mr. Wabash with a chuckle.

"Yes, I suppose so," Markley retorted, promptly; "put there, no doubt, to tantalize the fellows with suggestions of Kansas. 'Sorrow's crown of sorrow,' you know, 'is remembering happier things.' But as I was about to say, ozone dispels malaria, and keeps the climate free from bilious conditions. Besides, the ague is really a matter of morals rather than of physics, you understand." But we did not so understand it, and he therefore graciously proceeded to enlarge upon the statement for our benefit. "The ague always hovers about low, flat lands, where the soil is thin and jaundiced-looking, and where the inhabitants go on voting for Gen. Jackson for president. Take those quinine river bottoms in some of the Western States—I shan't call names—where the men gather at the saw-mill every Sunday to pitch horseshoes and shoot at a mark; there's where you'll find ague every time. Then move out on the high, open lands, where they have Sabbath schools and debating societies and collars to their shirts, and you'll see very little of it, usually none at all; the sickness there, when they have any, runs in the nervous way." Mr. Wabash laughed good-humoredly, and ventured some light remark about finding out more the longer we live; but Markley kept on in a solemn and impressive manner, as if charged with a special mission on the ague question: "It's considerably due to our school system, our free press, and our numerous churches, I tell you—added to the abundant ozone—that we are so little bothered with the thing in Kansas. We have four million dollars' worth of school-houses, and nearly two hundred newspapers, and churches till you can't rest. There's no foot-hold for ague among such things—and a sky full of ozone hanging over them. It's very much a matter of civilization, this

ague business. It's the difference between the sallow squirrel hunter, with his rifle on his shoulder and a gaunt hound at his heels, and the clear-complexioned, grammar-respecting man of the new era, with books and papers on the table and a canary bird swinging in the window. They had no ague in Athens, you may be sure; they have none in Boston—to speak of."—*Capt. Henry King, in Atlantic for August.*

THE ZOOTROPE.

When Mr. Edward Muybridge, of San Francisco, assisted by Gov. Stanford, made, in the spring of 1878, his first photographs of the horse in motion, it became evident to those who had been previously engaged in studying the subject of the locomotion of animals that they had never before had any such material for their investigations as that which he then presented. His process, briefly, consists in having a number of photographic cameras on a proper support near the level of the ground, at equal distances—say twenty-seven inches apart. Opposite to the cameras, and parallel to the line in which they stand, is a white screen or fence, the vertical lines, also twenty-seven inches apart, drawn on its surface, one directly opposite to each camera. A wire, with proper electrical connections, leads from each line to the corresponding camera. The animal whose motion is to be photographed is driven or ridden on a line parallel with the screen in front of the cameras, and as he crosses each wire the slide of the camera corresponding to that wire is opened, and a photograph of the animal in that position is obtained. In the experiments on a horse at racing speed, for example, the animal covers about twenty-two feet in each stride; ten cameras, therefore, twenty-seven inches apart, would record ten different portions of one stride or step The photographs thus produced show the successive positions, the transitions from one to the other of which are altogether too rapid to be appreciated by the eye

—*Art Interchange.*

EDITORIAL NOTES.

In view of the fact that several articles have appeared in the REVIEW which have provoked criticism, it may be proper to state that while the editor holds its columns open to free discussion of current topics of popular interest, he does not thereby necessarily indorse nor hold himself responsible for the statements or theories of its contributors.

ERRATUM—The specific gravity of the water of the sink hole in Meade Co., Kansas, described by Prof. Mudge last month, should have been given as 1.11 instead of 10.719.

REV. WILLIAM G. SCHAUFFLER, father of Prof. E. W. Shauffler of this city, the latter an accomplished scholar and master of several modern languages, has received from Princeton Colllege the additional title of LL.D. The New Jersey *Evangelist* makes a lengthy reference to the circumstance from which we quote a few lines: "Among the honors bestowed at the commencement of the present year, not one has fallen on a head more worthy to receive it than LL.D. placed by Princeton on the "good gray head" of the venerable missionary, William G. Schauffler, D. D., late of Constantinople."

WE learn from a letter to the American Library Bureau of New York, that Prof. R. A. Proctor, who was so enthusiastically received here in 1877, will return to the United States in October and remain until the following spring, lecturing in various portions of the East and West on his favorite subject, Astronomy. Among other topics he proposes to reveal some curious discoveries he has made in regard to the Great Pyramid. This subject having been pretty well discussed in the REVIEW by our well known contributor, Rev. James French, with the result of greatly interesting many of our readers, it would be particularly appropriate to invite Prof. Proctor to deliver that lecture, among others, here, and doubtless the Academy of Science will promptly open correspondence with him.

PROF. B. F. MUDGE of Kansas, commences in the REVIEW a series of articles combating in several points the views of the evolutionists derived from their geological researches and studies. As Professor Mudge has had as large an experience in the study of fossils as any man is this country, both in field and cabinet, his views will be regarded with respect by all classes of thinkers, and will doubtless call forth from all sides a pretty sharp controversy, in which we are confident that he will be able to maintain himself well.

COL. VANHORN calls attention to the fact that "the tornadoes are traveling a little farther north, and the higher latitudes are experiencing in July what we did in June. If meteorologists would note the fact that these tornadoes travel north with the season, they might find a clue to their origin and causes that is not known at present. In Texas, Louisiana, Arkansas and other extreme southern points they occur in March and April; in Kansas and Missouri, about the last of May and the first of June, and in Minnesota and that latitude, in July. This rule has its exceptions, we know, but the uniformity is such that a general cause must underlie them."

JOHN P. FINLEY of the U. S. Signal service, Washington, D. C. who has spent several days tracing out the lines of the June tornadoes in Kansas and Missouri, gave us a brief call on the 15th inst. His report will be looked for with great interest by the advocates of the various storm theories.

WE were much gratified a few days since by an unexpected call from the well known geologist, Tylor McWhirter, Esq., of Aledo, Ill.

PROF. C. E. ROBINS, writes from Summit, Colorado July 2, that "the 'Little Annie' mine is moving regularly along on her fifth annual campaign, and making a fair yield of amalgam with her ten light stamps. An important strike of $150 gold ore in place and in quantity has been made in the Missionary mine, at the base of South Mountain in this mining district. The 'find' has given unusual animation to the camp."

WE are indebted to Prof. Wm. J. Marshall of Fitchburg, Mass., for a series of photographic illustrations of the natural Yellowstone Park scenery and wonders, being *fac similes* of the beautiful views shown our citizens on the occasion of his lecture under the auspices of the Academy of Science last spring.

MAJOR DAVID J. MILLER, translator and chief clerk, in the United States Surveyor General's office, Santa Fe, New Mexico, writes: "I here inclose a $2.50 postal money order, wherewith to renew my subscriptional term to the REVIEW. I trust you are realizing in large degree the success which your excellent periodical deserves, and that your pecuniary success will keep pace with the celebrity your journal is attaining in the world of scientific learning and progress."

THE telephone has been put to a novel use in Italy. Professor de Rossel, of Rome, has used the instrument in detecting and measuring subterranean sounds at Vesuvius, and reports his experiments as highly successful. The telephone, before being adjusted, when artificial vibrations had no effect upon it, repeated violently the shocks and rumblings at

the bottom of the crater of the volcano, and, as the Professor expresses it, "registered shocks of earthquake otherwise imperceptible."

THIS is the way lady scientists in the United States dress and are appreciated at the President's levees in Washington. "A tall lady whose blonde curls were just shading into gray, her neck covered with diamonds, and a superb white satin dress trailing after her, was one of the most striking persons in the rooms. Great attentions were shown her, and admiration was heightened into something more when she was introduced as Mrs. Martha J. Coston, the inventor of the night signal system now in use by the Government."

WE call attention to the announcement of the Kansas State University in our advertising pages. This institution is well provided with every facility for teaching, including an able and experienced faculty, while the building itself cannot be excelled in the West in its adaptiveness to the purposes of its construction. Lawrence presents all of the attractions of a university town that so comparatively young a town can, in the culture of its people, and the quiet and charming beauty of the city itself; and the institution is rapidly gaining a national reputation.

EDISON'S Electric-Chemical Telephone dispenses with the necessity of holding the telephonic receiver to the ear, and besides furnishing a greater volume of sound, renders distinct the slightest peculiarities of the voice. It has been found to work perfectly at a distance of fifty miles. The improvement consists in causing the current to pass through a spool of chalk containing crystallized caustic soda, and having a thin tongue of steel resting upon it. The chalk is mounted on a shaft turned by a crank, thus causing friction; and when so operated, the current passing through the spool polarizes the chemical agent, and is thence transmitted through the steel tongue to a thin metallic diaphragm. The current only flows so long as the crank is turned. It is Mr. Edison's intention to furnish clock-work for the mechanical movement, so that it may be stopped and started by electricity at the will of the speaker.

The hottest day of the season in this city, so far, was Tuesday, July 22d, when our thermometer registered 80° at 7 a. m., 95° at 2 p. m. and 87° at 10 p. m. The heat in some parts of the city on that day, is said to have reached a maximum of 104° in the shade, at about 3 p. m.

THE British Museum is about to acquire a well-preserved Egyptian papyrus, belonging to the time of the later Ptolemies. It contains nearly the whole of the thirty-fourth book of the Iliad. The Museum has secured another papyrus, even more ancient, recently found in an Egyptian tomb, and containing an almost complete transcript of the eighteenth book of the Iliad.

THE KANSAS CITY REVIEW OF SCIENCE AND INDUSTRY, Theo. S. Case, editor, comes to us filled as usual with valuable facts, well discussed theories, and useful suggestions. It speaks well for the intellectual growth of the country where such magazines flourish amid the hurry of the busy workers of the prairies of the west.—*The Inter-Ocean, Daily.*

AMONG the prominent features of the Missouri University (an announcement of which appears in our columns, this month) is the engineering department, which is in charge of Prof. T. J. Lowry, C. E. The courses are: I. CIVIL ENGINEERING. II. TOPOGRAPHICAL ENGINEERING. III. MILITARY ENGINEERING. IV. SURVEYING. Each leading to its appropriate degree (and diploma.) The course in Civil Engineering is designed for those who wish to make either road and railroad engineering, bridge construction, or river improvement, a specialty. The course in Topographical Engineering is arranged for those who find distasteful the higher analytical Mathematics, and who show instead special aptitude for the surveys and improvements of rivers, lakes and coasts. The course in Surveying fits young men for navigation, practical astronomy and the U. S. Government trigo-

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nometrical, geological, magnetic, coast and river surveys, all of which are now under way. All departments of the University are in excellent hands and its greatly improved facilities for educating its students are being recognized throughout the state and the country. We referred but a few months since with pride to the splendid opportunities offered by this institution, as shown by its catalogue. Since then we have visited it and can now speak from personal knowledge. Every citizen of this state may send his children there with absolute confidence that they will receive the best of instruction.

THE Great Publishing House of George Stinson & Co., of Portland, Maine, moves steadily on in the even tenor of its way, apparently not feeling the dull times. During the year 1878 they sold over four million pictures of all descriptions. They publish every description of fine pictures, and the prices range from ten cents upward to twenty dollars per copy. We have personally examined several of their later engravings and do not hesitate to declare them exquisite in design and execution.

SMITHSONIAN INSTITUTION,
WASHINGTON D. C. June 18, 1879.

EXTRACT.

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Your REVIEW comes regularly and is always read with much interest.

Yours truly,

S. F. BAIRD, Sec'y.

A PRIZE of £100 for an essay on hydrophobia, its nature, prevention and treatment, having been offered by Mr. Stanford, M. P., to be awarded by the royal college of physicians of London, the Marquis of Salisbury has instructed the British minister at Washington to bring the matter to the attention of the Department of State, that the necessary publicity may be given to the same in the United States. The conditions under which the above prize is to be competed for are, that the essay must be in English, or accompanied by an English translation, and be delivered to the college on or before January 1, 1880. The essay must be accompanied by a sealed envelope, containing the name and address of the author, and bear a motto on the outside, the same motto to be inscribed on the essay, and may be the joint production of two or more authors.

CURRENT LITERATURE.

The most interesting article in the *American Naturalist* for July, is that by Prof. C. E. Stearns, on the Form of Seeds as a Factor in Natural Selection in plants.

The *North American Review* for August, 1879, presents the following attractive table of contents: The Work and Mission of my Life, Part 1, by Richard Wagner; The Diary of a Public Man; Garrison, by Wendell Phillips; The Power of Dissolution, by Edward A Freeman; The Founder of the Khedivate, by the late John L. Stevens; The Future of Resumption, by an old Financier; Recent Works on Ancient History and Philology, by John Fiske.

A WRITER in the Washington *Republic* says: "If personal appearance counts for anything, I am inclined to the opinion that the Administration has been fortunate in the selection of Mr. Clarence King to be at the head of the great bureau of surveys which the last Congress established. A keen, bright face, set as an index to a large well-developed head —a face frank in expression—pleasant, kind, firm; a short compact figure, with energy outlined in every movement—a rather rare combination among our public officers. I shall be disappointed if Mr. King does not make both a very popular and a very efficient director."

WE are indebted to Mr. S. B. Davis of the Ottawa, Iowa, *Democrat and Times* for an interesting account of an exploration of several ancient mounds near Eldon on the DesMoines river. Nothing of special interest was found within the mounds, but near the McClure group several relics were picked up: among them a stone axe weighing 3 pounds, several arrow heads and a "turtle back."

Professor Patrick, of the State University of Kansas, takes the position, in an article in the *Scientific American Supplement*, that alum baking powders may be used without injury to health, and sustains the position by a series of experiments with such powders upon cats.

The Jeannette sailed from San Francisco on the afternoon of July 8th. She is a bark rigged steamer of 420 tons register, 200 horse power, and apparently admirably calculated to successfully perform her mission. The *Boston Journal of Commerce*, however, thinks that the selection of a staunch sealing vessel would have been much better.

The *Boston Journal of Chemistry* is publishing an admirable series of articles on house building, in which beauty, strength, economy, convenience and hygiene are equally considered.

The *La Plata Miner* says: "This rich mineral mountain, Sultan Mountain, just south of Silverton, is making a splendid showing. At least six mines are already shipping paying ore in quantities that guarantee profits in their working. The mines that are at present being worked at a profit, are the Cleveland, Molos, King, Belcher and North Star, the last named having 200 tons of 100 ounce ore on the dump."

The *Mirror of Progress* is a new weekly edited and published by our well-known fellow-citizens Judge E. P. West and D. Eccles. It is presented as an exponent of western liberal thought. We bespeak for it a liberal patronage.

Experimenters in electric lighting will find a useful article in the *American Journal of Science and Art*, for July, upon a method of preventing the too rapid combustion of carbons in the electric lamp, by H. W. Wiley.

The *Sanitarian* for July contains an exhaustive article by Prof. Doremus, the distinguished New York chemist, upon Epidemics from a Chemical stand point, which contains important suggestions relative to the employment of "chemical agents for thoroughly disinfecting clothing, ships, and even our houses and hospitals of solid masonry.

The *American Antiquarian* for April, May and June, 1879, has made its appearance and is full of most interesting articles. It is now published by Jameson & Morse, Chicago.

Among the excellent articles in the *Popular Science Monthly* for July, is one by Prof. Wm. H. Wahl, of Philadelphia, upon Wasted Forces, in which the author shows, in a striking manner the boundless dynamic resources of nature, and proves conclusively that even should the coal supply suddenly fail, the manufacturer need have no apprehension of his engines stopping for want of motive power.

According to Prof. F. E. Nipher, of Washington University, St. Louis, Mo., in his report on *Magnetic Observations in Missouri*, 1878, the exact geographical position of Kansas City is Latitude, 39° 07.2′, and Longitude, 94° 37.7′.

PUBLICATIONS RECEIVED.

Other publications received: *Smithsonian Institute Reports*, 1876 and 1877.—*Proceedings of the Academy of Natural Sciences of Philadelphia*, Part I., January, February and March, 1879.—*Atti Della Societa Toscana di Scienza Naturali*, Mar. 9, 1879.—Louisville *Monthly Magazine*, February, 1879.—"The Microscope in its Relation to Medicine and Cerebral Pathology," by J. N. De Hart, M. D.—"First Catalogue of Radiant Points of Meteors," by Edwin F. Sawyer.—*The Pharmacist and Chemist*, Chicago, March, 1879.—*The Meteorologist*, Vol. 1, No. 4, monthly, Greensburg, Pa., 50c per annum.—*The Inter-State Normal Monthly*, Moulton, Iowa, 75c per annum.—*Our Mirror*, High School, St. Louis, $1 per annum.—*The House-Furnishing Guide*, New York, monthly, $2.—*Inventors' and Manufacturers' Gazette*, Boston, monthly, 50c.